TRAINING CUM WORKSHOP OF SC/ST KEY PERSONS OF TRIPURA IN REMEDIAL TEACHING OF MATHEMATICS AT ELEMENTARY LEVEL

VENUE	:	SIE AGARTALA
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BACKGROUND

Teaching and Learning of Mathematics has remained a subject of wide debate till to date. The students are opting it unwillingly and by persuation. They feel it is hard and dry and only intelligent students can read and do well. This is not a cup of tea for ordinary boys and girls. The notion has caused immense harm to the students and the subject.

The teachers also find difficult to communicate and get the knowledge retained in the students. 'Chalk and Talk' method does not work much. No serious efforts are made to motivate the students. They show little enthusiasm and interest in the subject. Consequently, the students fail to get competency in the subject.

One need not to go far to search the reasons of distraction and dischantment with the subject. It is generally commented that Mathematics teachers are individually motivated and take less interest in classroom teaching. They neither like to devote their time on coaching and guiding the students after the class nor use innovative approach of teaching.

The problems of learning mathematics are acute in tribal dominated states. So it was decided to organise a course for the key persons dealing with elementary level education in Tripura to discuss with them the ways and means to evolve corrective measures. The purposes were as how the classroom teaching should be made effective, how interest and motivation be created and how remedial courses should be arranged to the weaker and less achievers?

During the programme various mathematical activities and related issues were discussed, views expressed for and against, compiled and recorded for the report. The resource persons were drawn from the Institutions of Agartala to guide the course. The bussiness sessions were held in the SIE, Agartala (Tripura).

The report constitutes four Chapters. Chapter I consists the proceedings and chief activities of five days training; Chapter II deals with the problems of learning mathematics and recommendations for solution; Chapter III consists articles written by Resource Persons; Chapter IV consists the remedial lessons developed by participants, things to remember and remedial items and the annexure consists of list of participants and the resource persons.

It is hoped the report will be of use and interest to everybody. Suggestions to improve are welcome.

M M Pandey
(FIELD ADVISER)

ACKNOWLEDGEMENT

I acknowledge sincerely the assistance rendered by the Government of Tripura in general and Joint Director, SIE Agartala in particular to conduct the programme on "TRAINING-CUM-WORKSHOP OF SC/ST KEY PERSONS OF TRIPURA IN REMEDIAL TEACHING OF MATHEMATICS AT ELEMENTARY LEVEL" for five days from 14-12-93 to 18-12-93.

I am deeply thankful to the external resource persons like Dr.B.K.Dev Sharma, Department of Mathematics, NEHU,Shillong and Sri.G.S.Hathi, Department of Education Regional College of Education, Bhubaneswar who stayed with me at Agartala till the completion of programme.

The other local resource persons including Mrs.Chaudhury, Joint Director,Sri.N.Roy,Sr.Lecturer in the SIE, Mr.Sar, Mr.Debnath and others/co-operative. My thanks go to them also.

I am equally thankful to the Staffs who took all possible pains for the success of the programme.

NM Pandey
(Programme Director.)

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CHAPTER - I

Proceedings of the Programme

PROCEEDINGS OF FIVE DAYS TRAINING/WORKSHOP ON REMEDIAL TEACHING

14.12.93
FORENOON SESSION

The Training Programme on Remedial Teaching was inaugurated by Dr.S.Tewary, Secretary, Tripura University on 14.12.93 in the morning. Sri.Hreten Chakravorty,President Tripura Board of Secondary Education presided over the function.

In the beginning Mrs.R.Devi,Joint Director, SIE Agartala welcomed the guests,resource persons and the participants numbering more than 20 representing three districts of Tripura. She narrated her experience about the existing system of mathematics teaching in the rural and especifically in tribal areas. The percentage of pass in mathematics was very less. The tribal students are not regular in the class. Even they do not get proper guidances at their home.

Home environment is not homogenous to perform study. Secondly the subject is taught through traditional way without caring the interest and achievement of students.Consequently, the students fail in large number in the public examinations conducted at different levels.Mrs.Devi further hoped the orientation/training programme would be able to throw light on the problems - errors and solution of mathematics teaching and learning.

Dr.M.M.Pandey the programme Director, outlined the objectives of conducting training programme on remedial teaching in mathematics. In his opinion many options are open in higher classes to coach and to guide the weaker students. It includes extra coaching, tution and conducting tutorial classes. But at elementary level such practices are seldom adopted. It has been generally observed that the inadequate motivation, less uses of support materials, half hearted teaching, deplated conditions of school buildings and environment bring disappointing results.

Dr.Pandey observed that if such situation is allowed to continue, the future generation would be deprived of better education and better future. So it has to be ensured that the existing problems in teaching - learning process should be tackled through introducing remedial teaching. The inservice training would be an effort to contribute a little towards solving the problems.

Dr.B.K.Dev Sharma,Department of Mathematics, NEHU emphasised on the need of using all preventive measures of the distraction prevailing and arising while teaching mathematics. The weaknesses of students, the drawback of teaching and inadequate facilities of learning should be analysed and be remedied - Dr.Sharma expressed.

Sri.G.S.Hathi impressed upon the poor performances of students in mathematics due to various reasons - defective method of teaching,lack of motivation and interest in the students and lack of uses of mathematics teaching support materials. So it was necessary to adopt some supportive measures to improve the achievement of the students in the subject, remedial teaching was one of them -Sri.Hathi observed.

The elementary level knowledge and competency acquired get improved at latter stage.The students manipulates their mind for better learnings and its application. Inview of it,methematics teaching,a compulsory subject,should be given due importance and thus qualified,motivated and experienced teachers should be assigned jobs to teach as the primary students need more care and attention. Once they learn the skills of computation and develop aptitude the question of less achieving in mathematics would go. It was necessary therefore to practice other measures to expose them fully.

Dr.S.Tewary the Chief Guest traced the long historical development of mathematics and its growing importance and uses in the era of scientific and technological advancement. He narrated the contributions of noted Indian and abroad scientists and mathematicians which have immensely benefited. Dr.Tewary desired to improve the quality of mathematics teaching.

If it was done with sincerity and comitment, there was no need of adopting extra coaching and going for remedial teaching. He exhorted the teachers of the state and suggested them to enhance their knowledge before teaching. They should motivate the students and prepare for learning mathematics.

Mr.Hreten Chakravarty revealed in his presidential remark that the Tripura Board of Secondary Education had many schemes of teachers orientation in its store to improve the knowledge of teachers. He blamed that the teaching community was not taking its duty seriously. He deplored that the results in mathematics was very bad this year. So there was a need of improving the teaching by weeding out the weaknesses in the students. He appreciated the efforts of NCERT which had taken the job of orienting the teachers of the state. He depicted the prevailing scebario very discouraging especially in the tribal and rural areas and wished to improve it.

Sri.Chakravarty lamented that the teaching has become examination oriented. Infact teaching is not made in view to increase the knowledge, understanding and skill of application but attention is paid on as how to complete the course. Obtaining low percentage of marks is due to teaching of less qualified and untrained mathematics teachers by Sri Chakravarty observed.

Sri.M.Roy proposed the vote of thanks.

AFTERNOON SESSION

Dr.M.M.Pandey discussed the need of organising this training programme for the Key Persons of Tripura dealing with Elementary Education. The less presence of SC/ST personals from the State was due to non availability and being not qualified of such teachers.The funny thing was that even non-matriculates were asked to teach mathematics in Primary classes in some areas. In tribal dominated area students were not regular in attending the classes. Their inconsistant coming to school hampered the regular progress and achievement at the time of examinations.

Mathematics is understood as a touch subject. Pass percentage generally in the states of North-East and especially in tribal area is less.There is a complait from all sides that mathematics teaching is not given fair treat-ment. The teacher-students-guidance axis is under constant strains.

Secondly without proper learning and understanding of mathematics at elementary level the teaching in higher classes can not be improved. Unless the concept is clear and students are not thorough they can not acquire minimum level of knowledge to further their hold in science.

Sensing the acute problems in mathematics, it was decided to take a plunge and make an effort to see what measures could be taken to minimise mathematics phobia in the minds of all concerned. All the wrongs can not be undone, Educational Practices can only suggest the measures to be initiated -Dr,Pandey urgued.

There are general feelings that schools are not welequiped, have no place of proper seating and lack of congenial environment of teaching and learning. At the same time Govt. are not doing much as expected. But it may not be possible for the Govt. to spend all money on education, it has other areas also to look after. Thus finding less options, one has to seek the redressal within existing system and resources.

With the background, it was decided to conduct course on remedial teaching as a measure to reduce and weed out the weaknesses of students. This is the first efforts made by the office. It was meant necessarily to the resource teachers who would take up the cause on large scale.Infact remedial teaching is directly related to content enrichment Means tech test-reteach-retest. It requires continous efforts towards teaching in classroom giving extra coaching to the weak and poor students and even help the bright and fast learner. The Chief objectives of the programme were as followed:

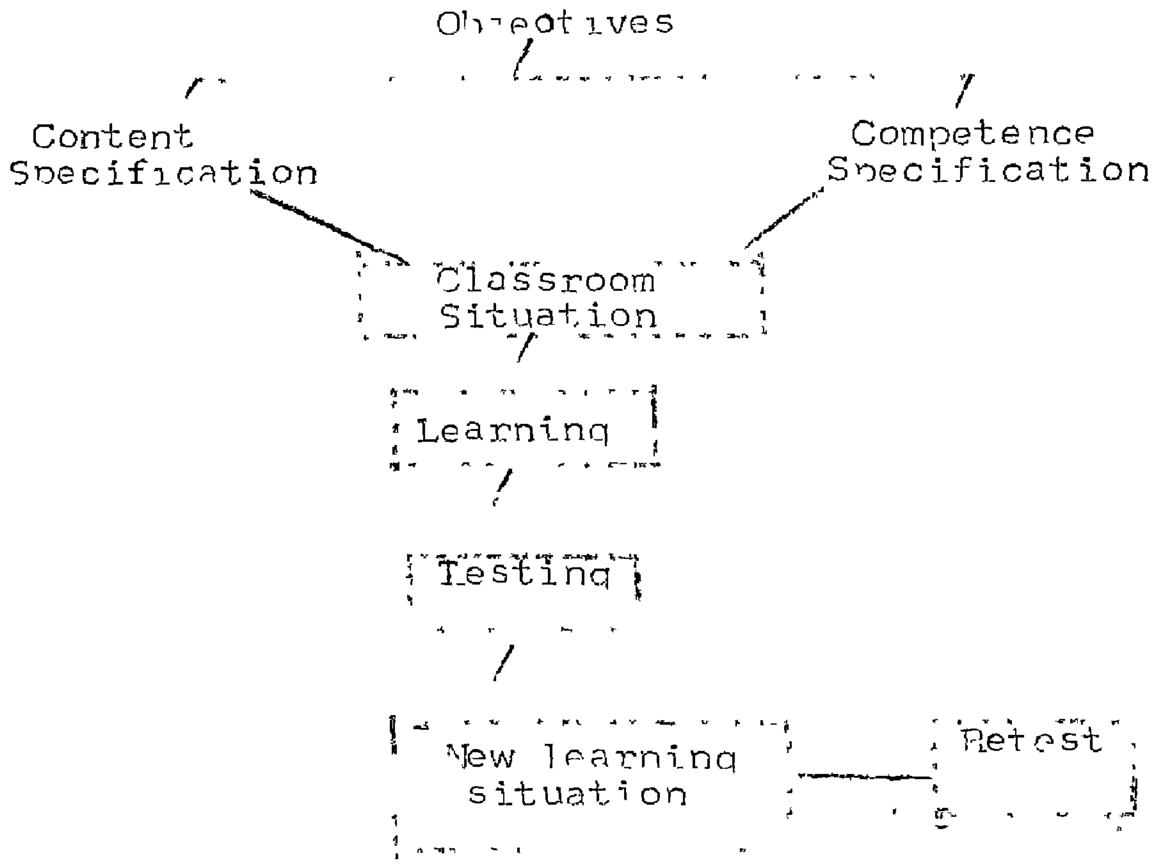
1. To discuss the common problems of mathematics teaching at elementary level in classroom situation of state schools and how to weed them out or to reduce to minimum.

2. To discuss the unsuitability of the curriculum-textbooks developed and to remedy them to maximum possible.
3. To expose with the nature, scope, need, aims and objectives of remedial teaching.
4. To discuss the nature of the slow and fast learners and the common problems coming on the way to understand and the common factors harming the prospect of teaching.
5. To deliberate on how to plan and manage the remedial teaching in the classes and outside.
6. To explain the strategy or measures to supplement the regular teaching to bring the slow learners on par or equal to the average and fast learners.
7. To evolve meaningful skills of remedial teaching with the help of the teachers and the other concerned.
8. To plan or develop some lessons on remedial teaching
9. To discuss the content cum methodology of teaching such as contents- topics on geometry, arithmetic and statistics to find out some common mistakes which Zeopardise the bright chances of fair scoring.

Dr.Pandey thus hoped that the efforts made to organise workshop on remedial teaching would certainly help in finding out solution of different nature.

Dr.B.K.Dev Sharma discussed about as how to plan the remedial courses. He emphasised that the first task in this regard should be to know the nature of weaknesses the students faced. It would help the teachers to evolve their effective strategy which would include making the time table flexible and alloting extra time to coach during the availability of time. He said that the teacher should maintain diary and plan as how to teach each topic, unit within the alloted time.

The Level of Minimum learning (MTL) must be fixed as the target and thus be assured to achieve. He gave a flow chart which symbolised the remedial teaching which was stated as:



He emphasised on creating congenial atmosphere of teaching-learning so that students could take interest. If the students do not grasp, second effort be made. Finally if it does not work, extra coaching should be organised in small batches. If micro level planning is done it would be more payable at elementary level.

Mr. N. Roy informed that in his state NCERT Mathematics books were being replaced by the mathematics books published by West Bengal Government from class 6-8 in phases. Before discussing the 'Problems in Developing number concept' he told that $\frac{3}{4}$th of Tripura area was sorrounded by jungles. The tribal students fell to come to the expectation of scoring good marks in mathematics. Sometimes it seemed alien to them. At the sametime there was lack of qualified and trained teachers in the schools. Minimum facilities of teaching was missing. The whole gamut did not help to prove the bonafide of the students as well as the teachers mostly in tribal areas.

He explained the ways to develope the concept of number in the beginning classes. Step by step method of developing concept is more beneficial. He quoted some examples of weaknesses or the points where the students fail to understand.

15-12-93

FORENOON SESSION

In the morning Mr.S.Sar, a Reader in Mathematics from Tripura University explained basic concept of 'Introducing fraction-problems and remedy'. He observed that the textbooks were lacking clear cut explanation as how to improve the mathematical ability. He drew some sketches through which $\frac{1}{2}$, $\frac{3}{4}$ etc as fraction could be taught easily. The students commit mistakes in understanding numerator and denominator and its relationship. If the basic concept was clear of what was whole and what was its part-certainly there would not be any misgivings about it.Mr.Sar invited many questions from the participants and answered satisfactorily. The teacher participants expressed their practical experiences while teaching fraction. Mr.Sar was effective in dealing with the points raised. It was nice session as the exposition was followed by the discussion.

Other Activities followed.

AFTERNOON SESSION

Dr.Dev Sharma discussed the 'Spirit of New language at Primary Stage'. He was forthright in explaining what language should be used while teaching mathematics contents. The distorted and vague expression in mathematics should not be used. It was totally against the spirit of functional teaching. In the Primary Classes, the students are not manipulative by their action and behaviour.They are in the process of construction and formation - therefore they should be taught with easy language and convincing skills.

New language of mathematics is now-a-days treated as introduction of new mathematics.The traditional treatment of contents had got changed. It has been replaced with new ideas,concepts and applications.

Set Theory has been introduced at elementary level and thus teachers find ample difficulties in developing the concept as such. But if the concept is derived from common life of the minor children who play, practice and apply their intuitution in choosing the things of their choice it would become more easier to teach such topics - Dr.Sharma exhorted. Infact nothing new we are teaching. Every topic taught has its roots and explanation in regular life. So the teacher should quote the examples from there.

Mr.B.C.Debnath had a discussion on 'Teaching of Decimal'. Often the students commit mistakes while computing on Decimals. Therefore it would be nice if the teachers drills them and put them on maximum alert of doing again and again. Infact it has been observed that if a boy is asked to add 1.05 + 23.03, he does not understand which digit should be placed where? In multiplication also they commit mistakes such as .1 x .1 =.1 which is wrong. Rather it should be .01. So it was better to practice and arrange some remedial measures to them.

16-12.93

FORENOON SESSION

Mr.G.S.Hathi discussed the complicacy of developing and teaching four fundamental rules of mathematics i.e. addition, substraction, multiplication and division. As an experienced teacher he dwelt upon the common mistakes committed by the students. It has been observed that students write plus sign '+' for 'x' sign and vise-versa which makes a lot of difference.The sign of dividion ' ÷ ' is mistaken. The tribal students often commits such errors and thus their results in mathematics are not good. However it requires regular practice Mr.Hathi observed. The exposition was followed by discussion, questions and counter questions raised and answered by the resource persons and participants.

Mr.Hathi stressed the need of teaching of four fundamental rules in no uncertain terms. The knowledge and expertise gained at this stage becomes the foundation of entire mathematics learning and application in future. Though there is no arrangement of special coaching for the students. Its extra renumerations are fixed to tutor the students, the teachers would be motivated to do that.He opined that only language should be used while teaching at the lowest level.

Sri.S.Lahiri, an old hand in teaching mathematics favoured to enact possible activities to teach geometry.As the subject is abstract and mostly imaginary it was better to develop the concept of line,point,angle,triangle first so that it go well to the mind of the learners.Once the understanding is clear, all shorts of deduction and theorem in geometry can be understood easily. Sri.Lahiri impressed upon the uses of instrument box in geometry teaching.

The participants got involved themselves in the discussion. They raised several missing links while teaching geometry in the class which deals with drawing projective lines and then subscribing to two and three dimensions concepts. From discussion it emerged that demonstration and participation would be necessary conditions of teaching and learning geometry.

AFTERNOON SESSION

Dr.M.M.Pandey, threw light on the importance of using evaluation and measurement in mathematics teaching. Measuring the scholastic achievement and evaluation the general performance of students opens new vista of rethinking and reshaping the strategies of teaching-learning process. If the weaknesses of the students are identified in a particular branch of mathematics or as a whole - a rethinking can be made to rejuvinate and re-energize all the resources. Without knowking the faults of the process and the system of teaching nothing could be improved upon and no feedback could be provided -Dr,Pandey observed.

He reminded that as the teaching had become objective based and application part was being given due weightage, it was more necessary that the stigma on mathematics as a hard subject needed to be removed. The teacher should take students in confidence and involve them to share the process. They should be given opportunity to reveal their mind. Maximum efforts should be made simultaneously to accomodate their feelings.

The weak students should be given extra time to accomplish the knowledge with the help of teachers. They should be given hometask to do and get checked from the concerned teachers. It would certainly help them to remove the anomalies in understanding.

So the teacher should also adopt all new techniques and tools to measure and evaluate the performance in the class. The students should thus be acclamatised to the tune of new teaching and examinations. Dr.Pandey felt, if comprehensive and continuous evaluation takes place,the students would feel nearer to the scheme of teaching and the teachers. They would feel emboldened and make efforts to bring them on the par of other classmates in the study of mathematics.

The teacher may use teacher made test and score objectively. Vague and discreet language should not be used while framing the questions. He also impressed upon the uses of diagonistic test to know the weaknesses and its causes. The teachers participated in the discussion.

In the last period, Dr.B.K.Dev Sharma talked about the managerial skills of remedial teaching.He suggested that on the basis of the achievement in the subject the good, medium and below average students should be classified first. The classes or coaching for average and below average students could be arranged seperately and be conducted till they come to the level of good students.

If there was dearth of teachers, the recess or vacant period could be utilised for giving remedial teaching to the students. Even the time of shift could also be utilised. The sole point was this that same teacher should be developed to teach as he knew the students and their behaviour patterns. However it would depend on the skills of the head of the institution and the manager. A skillfull head of the institution could extract the best out of the teachers - Dr.Sharma stressed.

Dr.Sharma talked on different managerial skills for adopting and conducting remedial teaching in mathematics for the students of different classes especially at elementary level.

17-12-93

FORENOON SESSION

Mr.G.S.Hathi discussed 'why remedial teaching' in the first session. He named the following assumptions:

1. The students fair badly in mathematics in the public examinations.
2. The courses and textbooks have been upgraded, so it becomes hard to understand them.
3. The base i.e. at the primary level mathematics teaching is not so good.
4. Non-availability of text-books on time which harms the regular teaching and learning process.
5. Lack of teaching facilities.
6. Without making the mathematics strong, the higher education can not be made strong in the light of explosion of scientific knowledge having strong link with mathematics.
7. Spontaneous learning of other subjects.

Thus adoption of remedial courses has become a must. At the sametime he emphasised on refreshing the knowledge of mathematics teachers also. The participants could count their practical experiences. They shared their perceptions of weeding away the backwardness of the students. They expressed that they were practicing remedial teaching in different form.

Sri.Hathi lamented that the private tution and coaching had reduced the value of classroom teaching. Irregularities had come and Zeopardised the sense of study. The honesty lacked from both the sides-teachers and students.

Dr.B.K.Dev Sharma stressed the need of teaching statistics at the Elementary level. He felt that teachers were required to know the norms or the standard of class and it help in that. On the basis of the scores obtained by the students evaluation could take place, the students could be classified and planned for remedial courses.

AFTERNOON SESSION

In the afternoon session it was decided that the teachers would be devided in the group to prepare some projects on remedial teaching. The points were made clear to them. They were explained as what they had to do. Every participant of the group was asked to develop a lesson through which it would be easy to teach the content. They were given home assignment to write down the things to be remembered in mathematics. They could prepare the lessons to be appended in the report. They were asked to write achievement/diagnostic test. The write-ups were screened and compiled by the Programme Director.

FORENOON SESSION
18-12-93

Mr. Rajlakshmi Devi spoke to the group about 'General position of Mathematics Teaching' in the State. She comprehended that 60% literacy was observed in the state and 60% population was below poverty line. She counted that 81% dropouts were found in the total area of the state but in tribal area percentage might increase.

She lamented that the teachers were less concerned with the welbeing of the students who were between the age group of classes I - V. They lacked the knowledge of child psychology and thus their treatment was rude and unconventional. On the otherside the single teacher schools did not cope up with the aspirations and demand of the people mostly in the rural and tribal areas. In many cases they liked to stay in towns - Mrs. Devi observed.

The Joint Director accepted frankly that state education was most politicised which should not be. She felt if no detention policy was followed then 75% attendance should be made compulsory so that first generation learners could be retained in the school. Let the children have minimum level of competency in the subject and the teachers fulfil that obligation. The efforts should be directed towards to have effective supervision, monitoring and supplying academic guidance to the children.

It would be better, Mrs. Devi felt, if the guardians were acquainted with the performances of their words. The strereotyped teaching should be discouraged.

The teachers should also be refreshed time to time.

She wished for making the stern rule to see that children were attending the classes and the teachers were performing their duty with full motivation and responsibility. Extra coaching would not be needed if sincere efforts were made by the teachers in the classroom teaching itself. The class assignment and task were necessarily needed to be checked regularly. New technique of teaching and learning could be devised.

Afterwards, Dr.Pandey; Dr.Sharma and Sri.Nathi engaged themselves in finalising the lessons developed, test items written etc by the participants. Those were re-written and given final shape to be included if they were found worthy. This continued till late of the forenoon.

AFTERNOON SESSION

Dr.S.Das, Director of Higher Education, Govt. of Tripura was the Chief Guest in the velidictory function. Mrs.R.Devi presided over the function.

Dr.Pandey presented a brief accounts of the activities conducted during five days programme. The participants felt that such programmes should be carried on not less than 7 days. They appreciated the efforts of NCERT.

Dr.Das, The Chief Guest of the occasion narrated the situation prevailing in the State as far teaching-learning was concerned. At one side there was a lack of interest,distraction in concentration, non-availability of minimum facilities at home and in the schools and on the otherside streotyped teaching and lack of motivation in the authority concerned were some of the factors responsible for the less scholastic achievement-Dr.Das observed. It was not like that the Govt. was not taking interest in fulfilling educational commitments.However if remedial courses were practised within the existing situation it would help the week students to cope up and the good students to fair well.

Mrs.R.Devi in her presidential remark louded the efforts made by the NCERT towards imparting various nature of inservice teachers training. It helped the teachers to improve their knowledge and the strategies time to time. Remedial courses were the demand of the time and the training would go a long way in helping the Key Persons to receive right type of skills of teaching.

Mr.J.Sinha, Lecture proposed the vote of thanks.

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CHAPTER - II

Recommendations

CHAPTER-II

ERRORS COMMITTED BY TEACHERS-STUDENTS
AND
SUGGESTIONS - RECOMMENDATIONS TO OVERCOME

A long session was undertaken with the participants for discussing the causes of possible errors committed by the teachers and students while doing mathematics sums and problems. At the sametime they were requested to forward their suggestions and recommendations to reduce such mistakes-errors. Many resource persons attended the session. The versions and views were recorded as stated:

CAUSES OF ERRORS/MISTAKES COMMITTED

1. A large chunk of Tripura population is constituted by tribals whose children have their own problems.
2. They are not regular in the classes. Being poor parents are not very much interested to see that their children are attending the schools regularly and studying properly.
3. Poverty cast its castrophe on the intellectual growth of the children not only among tribal children but among general also. Tribal girls and boys are not sitting idle in houses but looking after the minors or going to forest to collect firewoods to sale and earn.
4. Most of the students have no patience to grasp and understand mathematics. They feel it as burdensome. Lack of interest and inclination to learn also become the factor of commiting mistakes while dealing with four fundamental rules of mathematics.
5. Mathematics teachers are less motivated to take up the causes of teaching with sincerity and dedication Classroom teaching is becoming a less priority work to the teachers. They are devoting more time on private tution rather than making effective teaching in the classes.
6. The teaching is monotonous, not motivating. Only chalk, duster and blackboards are used. In elemen-

tary schools no proper arrangements are made for seating. No good atmosphere is available.

7. The State Government schools are poorly equiped. No library, no book, no facilities are available. Qualified mathematics teachers are not appointed to teach. Even they are not willing to work in rural areas.

8. Home and family position is not good. Many are first generaration learners. They are not helped in completing home assignments by their parents. They need continuous guidance at home but who will teach and guide when their guardians are uneducated.

9. Even the children do not find congenial atmosphere at home to read and study with concentration. In thatchet houses of poor family adequate amount of kerosin is not available what to talk of electricity. Lack of space is another problem there. It all contributes to non-performance in mathematics.

10. Mental retardation, being even less physically handicaped contribute slow learning in the subject.

11. Non-use of electronic-media is creating dischantment in the rank and file of mathematics students. The old method and techniques of teaching is causing great concern in the learners.

12. The slow learners and slow achievers are not getting adequate sympathy and affection from the mathematics teachers. Their grievances and difficulties remain un-resolved.

13. Tripura has a mixed population, Its three-fourth land is covered by the jungles. In the rural or mostly tribal area no mathematics teacher is willing to work. Due to disturbances and extremism no one wishes to stay in such places consequently most of the schools are functioning without teachers. Out of fear teachers seldom go to school in the remote places.

14. Mathematics as a subject needs continuous practice and guidance. In absence of teacher they are unable to cope with the subject. They do not do self study.

15. Neither teacher gives class task nor hometask.If sometimes they give they do not do proper correction. In want of guidance students are lost on the way of learning. Even they commit minor mistakes in doing simple sums involving signs, brackets, addition, substraction,multiplication,divisions,fraction and decimals which are basics of mathematics.

16. Once or twice in a year examinations are conducted. It becomes too heavy on students to remember everything at a time. Children at Elementary level even have not developed ability of reading and writing. What to talk of answering the questions after comprehending it. No continious evaluation is conducted.

17. The writings of most of the children are not readable. The capacity to express in language or make out the points from the language of the book is not upto the mark. It creates a hazard in perfect communication.

18. In the entire lot of children at lower level hardly a few are intelligent or above average. A good percentage of them are around average or below average who do not perform appreciably.

19. Another important problem with students is retention of learning outcomes. They forget within no time.They pose feel themselves mentally weak. They do not like to apply the mind due to fear psychosis and pressure to learn and retain.

20. While teaching, teachers do not wish to know about their aptitude and willingness to learn which should be the necessary and sufficient condition of teaching-learning process. Without having clear-cut understanding of the base or attainment in mathematics by the students teaching becomes meaningless and directionless.

21. The teacher does teaching in a haphazard way not in a sequencial form leading to leave loopholes and communication gap in learning and understanding. Solving some sums here and there does not serve the purposes.

The students do not get systematic guidance in the subject. Theorems and worked-out sums in the chapters are not explained properly. The students do not remember table and thus commit many mistakes while computing.

22. Majority of the students consider mathematics as terror. It affecte enthusiasm and interest of the teacher and the students.

23. The students are taught in a group, in a class not individually. Children in group fear to tell their weaknesses to the teachers out of fear or shyness.

24. Timidity, inferiority complex and psychological fear do not allow them to participate in the group work. They hesitate to answer out of fear and thus commit mistakes.

25. Communication gap between the students and the teacher is responsible to a great extent for slow learning and low achievement. The teachers either fail to apply suitable skills to communicate or just sidetracks the real issues attached to teaching. In both the cases the students are the worst sufferers.

    At the sametime teacher does not utter the word of appreciation. He always scolds and danigrades the child even on commiting a small mistake. The discouragement hampers the interest and motivation of mathematics learners.

26. Previously mathematics was an optional subject at High School. Now it is compulsory. The entire attitude about the subject so needs orientation.

27. In tribal and rural areas, the children are very irregular. They go to school casually. They do not practice mathematics. It creates backwardness. Even they go on changing the schools.

28. In the school, now-a-days too many outward activities are practiced. It prevents the teachers and students to be intouch with the subject.

29. Faulty development of syllabus and text books on mathematics creates havoc. The chapters are not arranged in a sequence. Worked out sums are not clearly explained. Printing mistakes, wrong answers etc are the common phenona in the text books. The theory portions are badly treated. All the flaws and drawbacks virtually do not help the teachers and students.

30. The teachers do not classify the students on the basis of their merit, mental levels etc. due to paucity of time and their other commitments. This does not allow them to prepare the strategies to tackle the problems of learning of average and below average students.

II. SUGGESTIONS/RECOMMENDATIONS FOR OVER COMING THE PROBLEMS/ MISTAKES

The participants forwarded their views for the improvement of situation in learning mathematics. The suggestions and recommendations were as recorded.

1. As the children are staying for about 17-18 hours with their parents, so the family atmosphere - activities should be analysed and its impact on their mental development be calculated before finding out the solution. This can be done through maintaining observation schedule, conducting interview, preparing anecdotal record, using check list etc.

After knowing the causes of non-availability of space, books, stationary materials, proper study facilities, the teacher-school can hold a meeting of the individual guardian to sort out the problems as far as possible.

If first generation children are learning in the family, they should be given all possible encouragement, assistance and facilities at home. The required books, materials should be made available to them. Even illiterate guardians should make it a point to sit with them to contribute to their enthusiasm. For SC/ST children Government are providing text books stationary materials.

2. At the time of appointment it should be made obligatory to the qualified mathematics teacher to serve in the rural and tribal areas for atleast in the beginnin of the service. The act will develop a positive sense, attitude and sense of proportion towards the poor and slow learners.

3. For poor children arrangement should be made to provide mid-day meal. This step will boost up the chances of retention of the children in the school. Once they develop habits to stay in the school, certainly they will concentrate on study vis-vis mathematics learning.

4. The school environment should be made congenial, peaceful and harmonious. Teaching is a subject of enjoyment not a burden. Every elementary school should have a building to protect the children from the sun and the rain and keep the teaching going unhindered.

   Minimum required aids, chalk, duster, charts, models, instrument box, mathematics kits etc must be made available for creating interest and motivation.

5. The teacher should use easy language for communication. Slow teaching helps the slow learners to grasp and understand. Giving regular class and home task and its checking create a habit to learn and do the task regularly. There is a need that mathematics teacher should be soft spoken, helpful, sympathetic to the genuine grievances of the students.

6. Physically handicaped children (of course with minor problems) such as shortsighted, hard hearing etc. should be dealt' with carefully. It will be better if mathematics teacher pays individual attention. For that smaller group should be created which may or may not be practically feasible.

7. Slow learners and slow achievers may be given remedial teaching through extra coaching.

   But before planning for remedial teaching, a proper diagnosis is needed. Diagnostic evaluation will be suitable to forecast the weaknesses, deficiencies and the problems of slow learning and less retention.

The teacher may go for inculcating a regular habit to learn, do the sums, complete the home task, get it corrected by the concerned teacher and remove the doubts. Practice, drilling of mind and doing the regular exercise in the subject improve the chances of fast learning and longer retention. It increases the capability to generalise the mathematical formula and techniques to do similar type of sums.

8. To improve the teacher efficiency, scholarship and ability the training atleast once in a two years is necessary. During inservice courses and training they should be exposed with content-cum-methodology of teaching. The latest development in mathematics at school level should be explained to them.

9. NCERT and CBSE are preparing text books at national level and SCERT and State Board of School Education/Examination at State levels. They should involve the mathematics teachers at some stage or other to be benefitted with their experiences of teaching and knowing the level of achievement. If it is not possible to include the teachers on the panel of writers, the script should be tried with mathematics teachers so that they may see it with students points of view.

10. Mathematics teaching through cassets, radio should be conducted to create interest. The recorded version of teaching also helps in raising level of understanding and retention. Under educational technology scheme, central Government is financing the states to buy twin-in-sets for getting the teaching/talks recorded for the broadcast made by the AIRs and

then let the students here and note down for their purpose. The value of electronics media is increasing day by day.

This act is highly useful for the low and slow achievers. But how many schools do have these facilities, that is a big question.

11. The teachers should consistently keep themselves in touch with the students activities -difficulties and guide them whenever possible and desired.

    As mathematics period is for 40-45 minutes, they should go in the class with the prepared lessons so that they can furnish the topic with revision upto the satisfaction of the students.

12. During first delivery of the lesson by the teacher, a few students out of the total do understand the contents. More than 70% just remain understood. This includes the number of the deficients, suffering from malnutritions, physically defectives, slow learners etc. For them the teachers should make it a point to revise the contents to clear the doubts of the students. For them remedial courses needed to be organised.

13. There is a need of wide publicity that mathematics is not a tough subject, a terror. This fear psychosis and misinformations should be wiped out. It is also interesting, marks fetching, motivating and profitable, this should be made clear to every concerned.

14. The students should be encouraged to participate in the group discussion. Group discussion and answering helps the individual child to weedout shyness, fear and commiting mistakes and make them bold.

15. The mathematics teachers are not only supposed to teach the subject but they should instill a sense of being competitive to achieve the greater objective in life. If the students possess competitive mind many problems like slow learning, slow writing and problems of grasping will automatically be solved.

16. The problem of communication is acute. The teacher has to see that he is using easy language to be understood by the students. Rather he should know the rate of understanding and grasping of students. In between teaching, he should parry some question to tie them to classroom activities. The teacher should speak in a measured tone and write clearly on the blackboard.

    He should utter a word of appreciation. Students should be encouraged and paked on the back. A smooth relationship between mathematics teachers-students creates interest and motivation to learn the subject perfectly.

17. The guardians should be persuaded to send their ward to school regularly so that they may not escape from class. Maintenance of regularity helps them to do home and class tasks.

18. Working days should be increased. At the sametime the sudden declaration of holiday on working days should be avoided or if any should be compensated.

19. The syllabus should not be vague and lengthy. The printing mistakes in the textbooks should be avoided. The theory portion should be clearly explained. Worked out sums should not have missing links. Chapters and contents should have been arranged in sequencial order.

    Clear cut development of books inspires the students to go for self study.

20. The teachers should classify the students on the basis of merit and achievement so that correct strategies can be evolved for average and below average students.

    But the teachers do not like to give extra time to coach the children. They are hard pressed, even mathematics teachers are to teach other subject also. So how far the problems of teaching will be solved, it is a matter of conjecture. Even the State Governments find difficulty in appointing mathematics teachers exclusively at elementary level due to hard financial position.

    Even then, if the problems are taken up in right earnest, we will be able to solve many of them.

CHAPTER - III

Articles

CHAPTER - III

INTRODUCTION

Dr. M. M. Pandey

These days education has become objective based and thus teaching is to be done on the line of objectives to be achieved. Sometimes tight scheduling of yearly curriculum calendar and crowded classes diminish the prospects of thorough and comprehensive form of teaching. Teachers find difficult to cope with the contents or topics to be taught in the limited time of period of 40-45 minutes when the attaintment levels of students vary from individual to individual in the classes,

Consequently, a group of students either do not understand or if understand, understand half or a little. Their results are so poor which lead to dischantment to withdraw from the classes and become the droped outs. Due to lack of acquiring competency they develop cold feet about the subject. Infact the class teaching is not spontaneous. The teachers and the students seem to engage them only in finishing the courses by all means. The haphazard teaching does not bring integrated understanding in the students.

Such situation is more prevalent in the North Eastern States , specially in tribal dominated states. The students are not regular and the teachers are in some cases, are also not qualified. Many students do not fit in the time table. It becomes too burdensome on them to grasp.

In the fitness of the things it was decided to conduct a course on remedial teaching especially in mathematics for the teacher educators/ M.E.School Headmasters/ Senior High School Teachers etc. who are dealing with the elementary education. The workshop for elementary level was more important as difficulties are faced more at this level. The following objectives were set for the workshop/ training.

1. To discuss the meaning, aims and objectives of remedial teaching and the programmes conducted for elementary level.

2. To discuss the strategies as how to enrich the students with contents in mathematics at elementary classes.
3. To discuss the common mistakes committed and weakness of teaching-learning process.
4. To prepare lessons on remedial teaching.
5. To construct diagnostic/achievement test items.
6. To discuss the support measures of regular teaching in classroom situation.
7. To conceive the things to be remembered in mathematics.

DECIMAL FRACTION

Sri.B.C.Debnath

I was asked to discuss on remedial teaching in connection with 'Decimal Fraction' at the elementary level. As this was a programme on remedial teaching, I gave emphasis on the specific parts/areas of the topics in which teachers generally find difficulties in teaching or in other words, where the students fail to understand clearly. At the beginning, therefore, I invited the problems from the participants for discussion. The following problems were raised and I discussed these points one by one.

1. What is the difference between ordinary fraction and decimal fraction?
2. How the concept of decimal point came into existence?
3. How to expand decimal fraction in the form of ordinary fraction?
4. Why are 3800 insignificant after a significant figure after decimal provided there is no more significant figure in the fraction?
5. Why the putting of 3800 necessary and when?
6. Students make mistake in division what is the remedy?
7. Students fail to understand 'why .9 = 1'. How to explain it?
8. Why is the decimal point shifted by two places to the left when divided by 100?
9. How to find out square root of 2,3, etc?
10. Why are digits taken towards right after decimal and why to the left in case of integral part?

Explanations

1. In the ordinary fractions, the denominators are any integers, whereas in the decimal fractions denominators are 10^n where n is a natural number.
2. We have place values as ones, tens, hundreds etc. and any place value is ten times the proceeding one when proceeded towards left. On the otherhand, each place value is one-tenth the previous one when we

proceed towards right. What happens when we proceed from one to the right? We get one-tenths, one hundredths etc. Thus the decimal point came into existence in between ones and one-tenths.

In the same manner, I gave satisfactory explanations to all the questions cited above.

COMMON DIFFICULTIES IN LEARNING ADDITION AND SUBSTRACTION (WHOLE NUMBERS) AND THEIR REMEDY

Shri.G.S.Hati.

I. If a child wants to do self in Mathematics he has to be thorough with certain fundamental concepts and skills. One of the most important aspect of Maths is the four fundamental rules in Arithmetic. If these rules are not understood properly and are simply practised mechanically, it will lead to many errors.

II. Lack of proficiency in these rules probably is one of the major causes of failure in Mathematics at the primary level. Here are some common errors in addition and substraction with suggestion remedies.

ERROR NO.I

LACK OF MASTERY OVER ADDITION & SUBSTRACTION FACTS

Examples : 5 + 4 = 8, 9 - 3 = 5

If a child has no mastery over addition facts, not only he will score low marks but also he will not be able to understand other questions and solve verbal problems. Moreover he will not be able to do any kind of transaction in day to day life.

Cause = Lack of mastery on addition and substraction.

III. Lack of Sufficient/adequate drill and rare use of construct objects in teaching.

REMEDY : Allow the child to find out himself the addition/substraction facts either by counting/using figures/using marbles or sticks/drawing maps etc.starting from very easy to difficult ones as follows :

In addition:

a - very easy

5+1, 2+1, 3+1, . 4+=, etc.

b - Easy

2+3, 4+2, 2+7, 3+3

c - Moderate
4+3, 6+6, 6+3

d - Hard
9+3, 8+4, 6+5, 9+9

e - Very hard
9+8, 9+7, 9+6, 8+5, 8+6, 8+7, 7+5, etc.

IV.

2. Give practical exercises so that the child does more work on hard and very hard facts than easy and very easy facts.

3. Arrange games on facts among two groups.

4. Ask to prepare magic square at home.

5. Make oral practice in the class.

ERROR NO.2

MISTAKES COMMITTED DUE TO CARRYING IN ADDITION AND IN SUBSTRACTION

For example:

$$\begin{array}{r} 35 \\ +17 \\ \hline 412 \end{array} \qquad \begin{array}{r} 35 \\ +17 \\ \hline 42 \end{array} \qquad \begin{array}{r} 35 \\ -17 \\ \hline 28 \end{array}$$

V. The child does not know why carrying/reduction is required, but learns only to add/substract mechanically.

REMEDY:

1. Use diagrams and ask quickly to desire the carrying principle from students.

Addition: 000000 + 00000 = 12
000000 0000 +9
21

$$\begin{array}{r} 12 \\ +9 \\ \hline 21 \end{array}$$

Substract: 000000 - 000000 = 12
000000 0000 -9
3

$$\begin{array}{r} 12 \\ -9 \\ \hline 3 \end{array}$$

2. Then add using expanded form as one ten +2 ones=12
9 ones= 9
One ten + 11 ones

one ten + 1 ten + 1 one

= 2 tens + 1 one
= 21

3. Then use the short form as

12
+9
21

ERROR NO.3:

SUBSTRACT FROM A NUMBER ENDING WITH ZERO

For example:

1000
-325

Cause - The child can not understand how something can be taken Zero in the tenth place.

REMEDY:

1. Ask the child to find out as

a) 100 -45 (b) 100 -25 (c) 100 -36 (d) 100 -5

(e) 1000 -276 (f) 1000 -105

(Ask the child to check the result by addition. If there is a mistake, let him correct it.)

2. Allow the child to discover the method of solution of this type of substraction by explaining in a number of situations.

3. Then ask to do difficult problems like;

2000 -235 10000 -246

ERROR NO.4: MISTAKE COMMITTED ON PROBLEMS IN SUBSTRACTION

Cause - Students are not acquainted with different types of languages used in problems on substraction.

REMDEY.- While introducing substraction acquaint the students with the norms of languages used in it such as:

(i) 5 - 2 = ? (ii) 5 - ? = 2

(iii) 2 + ? = 5 (iv) What +2 = 5

(v) 2 from 5 leaves what? (vi) 5 is how many more than 2.

(vii) 2 is how many less than 5

(viii) What is the remainder

(ix) When 2 is taken away from 5

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INTRODUCING FRACTION - PROBLEMS REMEDY

Shri.S.Sar

My discussion confined to 'Common Faction'.

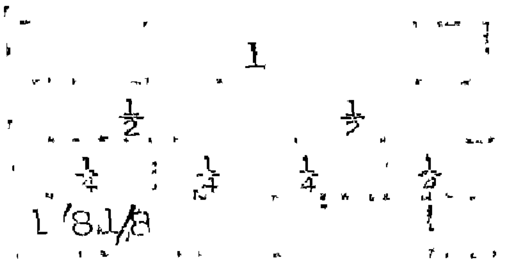
For considerable long period in the history of human civilization, integers were sufficient for needs of our ancestors. But with the advancement and development of civilization the idea of a part of a whole had to be considered. Land and produces were partitioned and concept for parts had to be developed. This resulted first in the concept of unit fractions which we recognise as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ etc. Searches in the history of Mathematics informed us that symbols of unit fractions were already know in Egypt and other places like in Mesopatania even before 1825 B.C. Mohanjodaro people also used the concept of numbers relating to fraction.

In vedic literature we can find uses of $\frac{1}{2}$(Ardha) $\frac{3}{4}$(Tripuda), $\frac{1}{4}$(Pada), $\frac{1}{16}$(Kala) etc. and in Sulvasutras we find operational procedure regarding fraction. The concept of common fraction is to be developed among the students as ' a new number, created to augment integers'. This is neither an integer which satisfies the definition of 1 divided by 2, nor an integer which when multiplied by two has a product one. To deal with such new situation it is necessary to expand numbers system. Students should realize that 'the evolution of number idea has been related intimately to the demands of variation operations'.

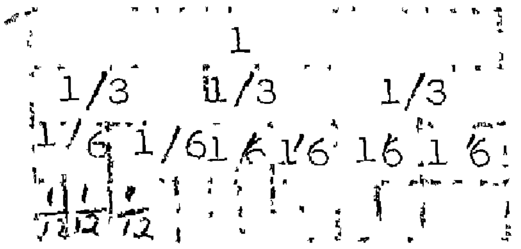
During teaching of common fraction we should take proper help of teaching materials like wooden disc, paper cutting, fraction, charts etc. The students may be asked to prepare such materials and this would certainly help them to understand and master the concept about fraction questions as 'What is a fraction? What are the components of a fraction? Why a fraction?' - are to be answered and explained. Acquaintance with the terms like numerator and denominator, difference between a whole and fraction are to developed carefully. A student must understand

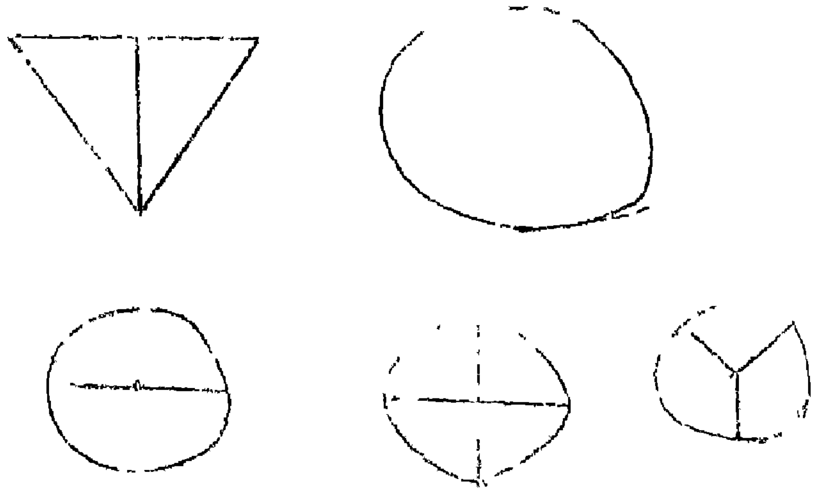
$$\text{A fraction} = \frac{\text{numerator}}{\text{denominator}} = \frac{\text{number of parts}}{\text{No of (equal) positions of whole}}$$

Gradually knowledge about different kinds of fractions (Proper, Improper, Mixed) are to be given and their examples, Salient properties, Inter-relation are to be stated. At the sametime the idea of equivalent fraction are to be given.



(A)





To be remembered/emphasis to be given to

(i) Each of two halves are equal (A fig.A)

(ii) Two halves equal to a whole etc.

Questions:

(i) How many fourths are equal to one whole?

(ii) Why is the sum of a half and a fourth less than a whole?

(iii) Why is the sum of a half and of fourths is greater than a whole? etc.

REMEDY:

Comparison between two or more fractions regarding equality and inequality is one of main important aspects of teaching. Need of finding L.C.M. of denominators of different fraction are to be explained and demonstrated carefully and not to be taught mechanically.

Four fundamental operations regarding common fraction are to be developed one by one with much care and interest. Ruler are to be developed through the activities of students. Different and adequate examples with simpler to harder are to given.

Problems relating to fraction may be categorized into few main categories and students may be asked to frame questions under each category. The social utility of fractions are to be explained which this may help the slow learners.

The causes of difficulties and personal problems of students in understanding fraction, if any, are to be found out and different remedial measures to suit the situations may be taken accordingly.

Different type of examples may be framed. During the lecture demonstrations were shown examples and problems were discussed and remedial measures were suggested to improve the quality of mathematics learning.

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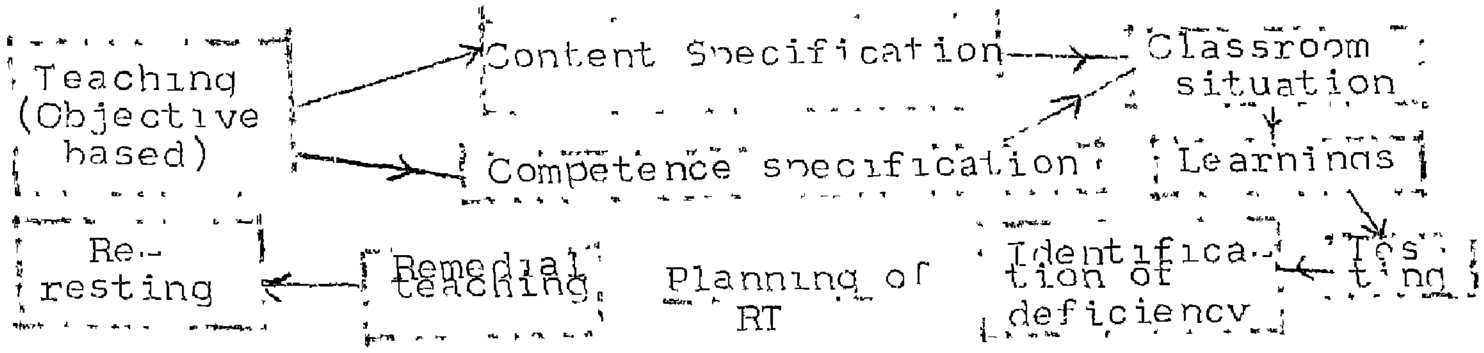
REMEDIAL TEACHING : PLANNING AND MANAGEMENT

Dr.R.K.Dev Sharma

1. The name, 'remedial teaching' reveals that it is a special type of teaching for a special groups who have 'diseases' needing 'remedy'. In mathematics teaching at school level remedy is for two groups in particular - (1) those who are below average (IQ-wise) failing to cope with normal class-teaching for one reason or the other and (2) those who are classes as 'slow learners'. So before planning any remedial teaching, it is necessary to diagnise the groups first so that appropriate device or methods can be planned.

2. In order to diagnose the 'defects' in the learners, there is a need of knowing the defects or deficiency occuring in two ways, viz - physically i.e. in the consent specification and mentally or in the competence specification. Remedy can be divised only after knowing the area of deficiency. This phenomena can be visualized through the following flow-chart:



Thus, it becomes clear that remedial teaching (RT) Primarily is a function of three parameters, viz.teaching (T), learning (L) and testing(t).

Obviously, here learning means minimum level of learning desired to be attained by the learners. On the otherhand, any kind of teaching is a function of MLL, time and resources. Because, a teaching is to be performed by a teacher (resource) within a fixed frame of time (routine). So, before conducting remedial teaching one must be aware of all these factors to make the planning functional and effective.

3. Next issues comes for whom the remedial teaching is to be planned? While diagnosing the causes of deficiency, it should be remembered that IQwise three class of learners will come to light. These are (a) above average, (b) average and (c) below average. Within the third category there will be a sub-class known as 'slow learners' who can, if attended well, easily be raised to average standard.

Among the class below average those who are 'low achievers', the remedial teaching should be more tricky but progressive. For them if some diagnostric tests can be framed before introducing remedial teaching, it would be easier to know the arena of deficiencies together with the possible causes needing appropriate remedy. Because in learning mathematics these are quite few special type of constraints like fearpsychosis leading to mathematical anxieties, ill effect of teaching mathematics by low or non-qualified teachers etc. To sum up we may say that the domain where the deficiencies are occuring in learning mathematics must be known, although deficiencies will occur mainly in one or more area(s) of knowledge, understanding, application and skill.

4. Remedies in the form of tutoring as well as counselling may be arranged within the routine schedule or beyond the routine schedule. Whatever is done, it must be done using managerial skill to teach mathematics to have effective results. Infact, the communicative approach of teaching mathematics will be more effective approach for the low achievers to develop the thinking process in mathematics. In order to inbuilt strong foundation on concepts and doing skills, drilling, oral and how to solve a problem may be practised. Mathematics is a doing subject and to do correctly a learner must be clear about what to do, know the logical approach and also know specific terms, terminologies formula.

Remedial teaching is also meaningful to the above average group to achieve better performance. But since the low achiever group in our schools constitute a major part, to begin with we may plan remedial teaching for this class only. It would be better if the teacher teaching in the classroom situation records the causes of deficiencies and hand over those to another teacher to deal remedial teaching

6. While planning the remedial teaching, the teacher should make groups according to the amount of needs. Because, the same type of remedies may not functionally work for different groups with different type of deficiencies as the same type of medicine does not work for different diseases. Here comes the need of individualised attention to be paid by the teacher offering remedial teaching.

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Evaluation of Learning Mathematics Outcomes

Dr.M.M.Pandey

Rationals

The purpose of providing experience of the children is to develop abilities to learn more. The effectiveness of the teaching, learning programme can be measured through a planned process of evaluation. The achievement or learning outcomes in the subject based on the cognitive, affective and psychomoter objectives are measured for providing the child a job or to place him in a desired set up. Infact measurement is a pre-requisite to an evaluation.

Measurement provides informations on 'how much' pre-decided instructional objectives have been achieved by a child in a particular sequence of teaching conducted by the teacher. Evaluation goes further and passes on value judgement on the measurement of learning outcomes in terms of direction, extent and future accomplishment. It explains the effectiveness of learning objectives and processes. Let us discuss the design of evaluation.

Designing Evaluation

Evaluation process derives most of its laws and consistancy from psychology of learning. The learning processes are decided by the interest, motivation, aptitude of the children posses . These aspects belong to the tenets of psychology which casts its spell on teaching-learning situation of which evaluation is to be done.

Evaluation is an integral part of teaching and learning process. So evaluation draws its lessons from psychology and maturity level of the students, methodology of teaching, nature of subject and learning outcomes. It is better to discuss one by one.

1.1. Maturity Level

The method of evaluation at elementary level differs from that of secondary and higher levels. It happens due to difference of maturity gained in the subjects. Writing, observing and capacity of computation, doing mathematical sums on own, memorising the contents etc. decide the level of students maturity While evaluating one should keep these factors in mind. Infact level of tools and techniques of evaluation must synchronise with the level of maturity.

1.2. Process of Learning Mathematics

Process or methodology of learning is another important factor which influences the courses of teaching and learning. The process of learning is guided by the process of teaching also. The way teacher communicates, leads to the easy understanding of the content. Here the teacher is required to know the psychology of learning and the ability of the children to learn. Effective entry behaviour, collateral effect of instruction, involvement in the learning process all decide the effectiveness of the process of learning.

1.3. Nature of Mathematics

Design of effective evaluation depends on the nature of subject, counting, calculation, measuring etc. These are virtually the parameters of mathematics which inspires much thinking and involve human intellect. Continuous involvement and exercises set a pattern of discipline in the students of mathematics. They formulate the axims conciously or unconsciously to be proved by assimilating new thoughts. Imagination and curiosity to reach the solution instills the sense to adopt 'trial and error method of learning'. Mathematics is termed as a subject of thought provocking. Therefore while designing evaluation, it is better to know the subject content to make evaluation useful.

1.4. Outcomes of Mathematics

Before teaching mathematics instructional objectives are predetermined to be achieved. Why it is taught, what are its purposes and what would be the outcomes of teaching are the hallmark of teaching. Mathematics has been made an integral component of curriculum being followed right from class I. Its learning enables the child to solve his daily problems, prepare for professional and science courses, make them purposeful, productive,constructive and develop power of concentration,self reliance, critical thinking and reasoning. It is better to take up evaluation objective referenced so that outcomes can be evaluated scientifically.

The evaluation based on instructional objectives is widely welcomed. But at the sametimes it is highly required that the objectives are classified. An evaluator should be clear as what objectives-knowledge,application,analysis, synthesis or understanding, he is going to evaluate.Taking up evaluation on specific objectives serves useful purposes.

"The combination of the formative evaluation using subjective reference testing procedures and the summative evaluation using norm referenced testing procedures gives both the learner and teacher adequate informations".These informations are related to extent of learning outcomes and causes of non-achievement. The scores achieved can be compared on individual, group and larger norm group basis. The informations on non-achievement helps in deciding about taking up the remedial measures.

Evaluation of Ability gained in Mathematics to be Applied

The most valuable aspect of learning mathematics is adaptation and application at the time of need.This is also an appropriate behaviour to evaluate. For the purpose various methods are practiced to evaluate such behaviours. The children are asked as how do they apply the skills of Mathematics in common life. Even standardised test constructed for the purpose are used for collecting data and analysing the desired results. The main emphasis is on evaluating the ability to apply mathematics learning and skills.

By discussion and by observing facial expression of the children an evaluator can get insight into the pupils maturity of understanding. Listening the conversations of students helps in knowking the level of understanding of the children and wishes to apply in their life. Discussion with parents provides enough data and important clue as whether the children are studying mathematics properly at home or do they have not some competency in it.The parent teacher meeting helps to know the need of taking corrective measures to develop the ability to understand and apply.

Evaluation of Attitude and Application

The general attitude towards mathematics can be defined in terms of behaviour to the extent the children likes or dislikes it. If a child gets enjoyment in doing mathematical operations one can conclude safely that he is taking interest and have a sense of appreciation. It shows the attitude of the child also.

Appreciation and attitude are related to the content and the use of mathematics. Appreciation include,tendency to consider mathematics as a part of common life activities, the ability to precise the logic of explanation and description of mathematical phenomena and the significance of the subject in the social context such as business industry etc. Attitude refers to the perception a child develops for reading mathematics as a subject.

Various types of evaluation and testing techniques are used to evaluate attitude,aptitude and appreciation. The tests to evaluate may be teachers made,questionnaire,observation schedule, anecdotal responds,activities schedule etc. The teachers are preparing reports cards on the pupils achievement. The attitudinal aspect can be assessed by scales.

If attitude and appreciation part of learning mathematics is evaluated properly and their teaching is organised, it would bring the desired outcomes. If the students become responsive means they grow positive attitude towards learning the subject.

Problems with Evaluation

Effective evaluation suffers from various problems. In most of the cases teachers use the old form of questions without caring to set it within the syllabus taught. Even in the public examinations, it is generally found, old and traditional questions are asked or repeated. It becomes stereotyped and thus creates less enthusiasm among the students to learn mathematics.The question does not lead to formulate any hypothesis and get the proof. Sometimes the language of the questions is so complex, vague and suspicious to understand. They do not carry the real message what is wanted to be extracted from the students. We can sumarise the problems of mathematics evaluation as:

(1) Use of traditional and old questions
(2) Faulty framing of the questions
(3) Questions do not cover the syllabus, even sometimes they are out of syllabus.
(4) Lack of qualified mathematics teachers to teach the subject.
(5) Lack of proper environment of mathematics teaching. Uses of less resource materials for effective teaching of the subject.
(6) Lack of using continuous and comprehensive evaluation.

If these problems are sorted out the evaluation programme in mathematics can be made effective. As mathematics is a subject of practice and exercises, the diagnostic evaluation will be more scientific and objective at elementary level.

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Diagnostic Testing and Remedial Instruction

Dr.M.M.Pandey

Background

Human system is in consistent interaction with environment and the process through which human beings learn . All the pervasive behaviour modifications in life of a child received is due to experience and education.He interacts with various incidents in common life,gets influenced and learns to a certain amount. Later on organised learning takes place.

However educational changes mostly takes place at cognitive level. If desired amount of behavioural modifications do not occur in stipulated time or occur very slowly in respect to an individual child the phenomena is generally termed as backwardness.

Many efforts have been made to solve the problems of backward and weak students. However the need is that children should not be treated as an element of producing good but as a human being who can think and reason. An individual child grows with his own pace, sets a pattern, interacts and gets experiences on his own. Some children come from poor and backward family which cast spell on their intellectual attainment. Due to these problems mathematics learning has suffered at every level.

Problems:Issues

Apart from their home, the children are facing acute problems in school related to achievement, adjustment and functioning. The tension, conflict and anxiety become the sole causes for falling in the standard of learning. Ineffective teaching due to various factors beyond the control of the teachers harm the better chances of learning. It leads to heterogeneity in the achievement of individuals. As learning is hierachical in nature, three levels of learning or adaptive systems have been identified on the basis of intelligence.

"Level I system only knows they have no intelligence. Level II systems know and learn; they have some intelligence. And level III systems know, learn and think, t have a high degree of intelligence" (Anderson 1975). Hum beings are at the highest level of intelligence who are (pable of reacting at all three levels.

Meaningful educational efforts should be made t identify and recognise issues lying with backwardness and low achievers in mathematics. It is also true that all human beings are not equally capable to operate in subject with the same depth and speed. Individual differences do exist. External factors also influence the learning sequence. The sequence may be high and low in order.

"Effective learning results in complex behaviour patterns which may be differentiated into more or less related hierchies of habits, skills, understanding, feelings and desires . The criteria for determining optimum sequence are of two types (1) those related to the physical, mental and emotional maturation of the child and (ii) those related to the nature and complexity of the behaviour to be learned. These are really different aspects of the same developmental process. Properly conceived both results in sequences are challenging, purposeful and meaningful for learner"(Cook, 1950).

In mass education, sequences of experiences are perceived in view of physical, mental and emotional maturity of a child being attained at a particular level or age. The children are promoted in the schools from class to class on the basis of the desired level of performances or befitting to the instruction imparted in a sequencial class. But in practice the regular sequence of optimum achievement in case of weak students does not happen. Generally it is found when dingnostic tests are conducted. Even after studying a subject for 3 - 4 years, the children commit common mistakes; for example

$8 \times -8 = 64$; $1 \div 1 = \frac{1}{2}$

$6x^2 + (-6x^2) = 12x^2$

Reasons are not far to seek. Poor quality of teaching, inadequate teaching facilities in mathematics, lack of motivated and properly trained teachers to use resource materials, liberal promotion policy, joining the class by many first generation learner etc. are the responsible factor for low achievement. As the individual child has his own way of learning, it should be recognised by the teacher while planning for his teaching. Learning deficiencies should be detected and corrected at elementary level otherwise wrong learning will continue to mislead him in future. All required facilities need to be provided to the weak children. Infact learning brings change in behaviour which is caused due to external environment and internal patterns.

Diagnostic Test

Diagnostic test is designed to locate the particular source of a person's difficulties in learning, especially in school subjects. It provides clues to what further measures of instruction, guidance or study are needed.

Diagnostic tests are constructed to identity specific learning difficulties in case of an individual child. If a teacher is armed with the information about the status of a learner he would try some alternative strategy to remove the difficulty. If the test is applied on a group and the group is also suffering with the same difficulties, common measures can be planned for the purpose. A teacher has to ensure that the children show appropriate readiness before being exposed to the subsequent course or topic.

The diagnostic tests are mostly achievement test which are based on the course already taught or is being taught. The low achievement or attainment in the evaluation reveals the difficulties and deficiencies. Diagnostic test can be prepared on predetermined objectives. The deficiencies or weaknesses thus found can be put to remedies.

Infact the following criteria can be fixed for the effective diagnostic testing.

(i) It should be an integral part of the curriculum based on objectives and experimental evidence of learning difficulties.

(ii) It should point out the errors regarding learning and teaching.

While constructing the diagnostic tests the steps supposed to be followed are identifying learning difficiencies, analysing errors, content, identifying difficulty in learning etc.

Remediation

Remediation is a process to correct the errors committed by the children due to certain weaknesses. For helping the poor children in learning mathematics extra coaching can be given to them. Tutorial classes in the subject may also be arranged to help the weak and slow learners. At elementary level continuous guidance and counselling is required to enable the learners to cope with the learning situation. Giving home assignments, making necessary instructional correction leads to better learning.

At the sametime, home environment should be created suitably for proper learning. The guardians and parents should make a point to seat with the children in the evening and share their difficulties and problems. Affectionate dealings with them encourage and make enthusiastic.

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Can You Reduce Students Difficulties In Mathematics?

YES ; Sri.G.S.Hati

- by allowing the students to discover principles,processes solution by themselves.
- by encouring freedom to the child to ask questions.
- by assignning sufficient homework asking student to practise more for difficult areas.
- by developing the lesson with the help of average/below average students.
- by assigning classwork to help the needy children individually.
- by recapitulating previous knowledge required for development of the present lesson.
- by writing systematically on the board without leaving any step.
- by testing the children just after completion of a unit/sub-unit (oral/written).
- by devoting more time on difficult fundamental concepts with teaching.
- by arranging revise work after some units are complete.
- by arranging drill work for even minute skills even sometimes for the whole period.
- by asking questions at regular intervals while teaching
- by proceeding from easy to difficult concepts.
- by giving sufficient examples to clarify the concept.

Mathematical Game

For example:

(a) Divide the students two groups

(b) Chose one child from Group I and one from Group II by lottery.

(c) Ask the child of Group I to wrote a problem on addition on the board and let the child in Gr.II solve it.

(d) If he can not let chose a child from Gr.I solve it.

(e) Then chose two children by lot from each group as before. Now the child in Gr.II should ask a question to the child of Gr.II.

(f) This process may continue and scoring is done simultaneously by the teacher.

N.B. Same problem should not be repeated.

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NEED OF REMEDIAL TEACHING

Edited by Dr.M.M.Pandey

It is observed that a majority of the students are weak and backward in mathematics in comparison to other subjects. They are fearful and take less interest in learning and studying the subject.

Infact more than 70% children come from rural areas and that also from poor family whose social and economic status is very low. The children of these family are hard pressed, mentally perturbed,backward and slow in grasping the events. Even such children find very difficult to adjust with the phenomena not suitable to them. The whole things create a situation of disappointment being shy and escapist.

The social, biological and economical problems cast its effect and make the students mentally backward and weak in dealing with mathematics. In most of the cases it has been found that children are weak not by birth but due to tension, dispute and acremony prevailing in the family and society. The teachers are also responsible to a great extent who have failed to build up a positive attitude around. Mathematics teaching can be made interesting and joyful if all possible strategies are followed in the classroom as well as outside. Organising remedial teaching will be one of the strategies. Let us discuss the basic problems with mathematics learners first and the need of remedial teaching in the light of it.

The participants were given the assignment to express their views regarding problems the students and teachers were encountering while gathering involved in teaching and learning mathematics.They were also requested to highlight the needs of adopting remedial teaching courses and how? They wrote their feelings in different tone and tremour which were edited and compiled and presented in the following manners.

Problems

A good percentage of students at elementary level come from poor family to the schools of rural areas.

In tribal areas of Tripura Schools do not have facilities to boost up the chances of teaching and learning. Due to obvious reasons of social disturbances the teachers either do not attend the school regularly or even do not like to stay. Thus days together students fail to meet the teacher.

The general opinion of the participants was that many schools do not have building or even roof to save the children from the sun and the rains. Poor guardians were not willing to send their wards as they had developed only one concept of education that was "if one is passes certain course or degree he must get a job equivalent to it. If no job is guaranted no need of sending the children to school and wait for many years for completing the system of education'. Luckwarm and less proficient teachers fail to cope with the course and syllabai framed for Primary level. If the teachers are unable to convey and communicate the correct implications of the topic what would be the fate of the children?

Hetrogeneous nature of class students which comprises mentally weak, slow and low achievers fail to grasp teachers delivery. A high percentage of students do not understand in classroom and thus due to lack of proper guidance remain as it is. It causes great harm and thus leads to a large number of failure in mathematics examinations.

Motivational and interest factors are also responsible to learn the subject. The children have less patience to solve the sum and thus feel insecure. They do not like to practice when they feel dischanted in the school. They do not receive any help and words of encouragement. It makes the students helpless. Untimely procurement of books, exercise books and other required reading materials creates slackness and frustration. Non availability of useful assistance puts the children in unviable position. Thus mentally tortured students can not fulfill the commitment of proper learning.

No facilities other than the books, chalk,duster, blackboard teachers are visible. No electronic media is used to make the teaching joyful and attractive. Cassetts, films or even the twin-in sets to use them in offtime are hardly available. Another problem is that of retention. Hardly 10-1 % students are capable to retain the learning outcomes. It may be possible with mentally retarded but can not be true with the students of general nature.Infact after class they do not go for revision and practice.It causes loss of memory. Some students have short or less memory power. Sometimes learning requires to be memorised.

Seeing all those unfavourable circumstances for learning one can say safely that the teachers and the management all are at faults and responsible to uninspiring learning of the students. Teachers do not adopt easy to hard or from known to unknown method of teaching which leaves many missing loopholes in teaching and learning. The adoption of casual attitude, insincerity on part of teachers make the students less interested.

Physically handicaped and abnormal students face enormous problems. Some may have problem of hard hearing, shortsightedness,low achievement, mental derailment,disturbing instinct etc. Such children become the permanent problems to the class teachers. At supervisory level no action is taken against the errant teachers even who do not involve them in classroom teaching but tution and treat the students liesurely. They are not accountable to the failure or unsuccess of the learners - boys and girls both.

Need of Remedial Courses

The problems discussed leads to search for alternative strategy of teaching. Organising remedial teaching is one of them. However it can not compete with regular classroom teaching but it can improve better teaching in the subject.

Sri.A.C.Nath felt that "Remedial teaching attempts to remove the fear of mathematics learning, makes the communication easy on one to one basis, encourage to be free to ask and get their difficulties redressed,get the weak students of all kind motivated and interested in learning, increase the attendance of the learners and to instill self confidence".

Mr.Prantosh Datta emphasised to give teaching of four fundamental rules of mathematics towards the first strategy.According to Mr.Datta, in remedial teaching, a teacher comes prepared with a lesson plan and proceeds from known to unknown which can be easily conceived by the students.The remedial teaching provides opportunity to evaluate the learning outcomes by using objective type questions,to use the local language for communication, to involve the students mentally in the learning process and make them self dependent to think and to reason.

The need of using remedial teaching for the children was more - Mr.Uttam Sinha observed. The children at this stage easily forget what they learn and are unable to retain. Therefore, it was necessary to put them on practice. Mr.Sinha felt, such teaching was done for slow learners and low achievers. Remedial teaching encourages participation and involvement in the teaching-learning process both the sides. According to Mr.Sinha, before going for offering remedial course to a group, it is necessary to classify the group and diagnose the level of difficulty they have.Once the level of achievement or weakness is known it would be easier to deal with the problems effectively.

Arbind Nath advocated for drilling the minds of the children because as much as it was put to practice it would be sharpened and become more receipient.Sri.D.K.Dey dwelt upon the concept of mathematics which was continuing right from the inception till the birth and the growth.All mathematical processes are taking place in the natural growth and development. But being a product of mathematical estimation child fails to learn it formally upto the satisfaction. It was therefore necessary to innovate the method suitable to the learners. Mr.Day submitted his views in favour of conducting remedial teaching which improves faulty method of teaching,insufficient classwork and mechanical way of teaching learning processes.

Mr.D.K.Paul stressed upon making teachers's guide available to the mathematics teachers. At the same time they should keep in touch with the development taking place in the field of mathematics education at school level. He supported the views regarding appointment of qualified and motivated mathematics teachers.

Mr.Nityendu Chaudhury realised that remedial measure was highly essential to be used to the problem children. He further wished that NCERT should orient mathematics teachers time to time to rennovate their knowledge.Sri.N.Dey pleaded that remedial teaching would be suitable to the first generation learners as it makes them creative and self studious. The teachers should adopt and use teaching aids to develop the concept of addition,sunstraction,multiplication and division in the students. The students should also be impressed upon to practice verbal counting,table etc.

Mr.K.Goswami was of the opinion that the teacher should come in close contact with the children and should always use the word of appreciation. Using good words motivates the children and it was fruitful - Mr.Goswami observed. Mr.Sudipta Das suggested that elementary school children should be taught in small group . as they need individual attention. The students should be pursuaded to learn and complete the assignment for evaluation and marking.

The weak students need sympathy and love. Their creative brain should be utilised atleast to have minimum level of learning in mathematics. Mr.K.M.De realised the importance of resourceful teaching which was required most at the constructive period of the children. All sorts of positive attitude, right habits and correct aptitude could be developed through teaching mathematics. All the steps which improve the weakness - mental and physical- could be termed as remedial.

Sri.P.K.Sahu expressthat the children should be inspired to become self dependent and competitive. Sri.Niranjan Roy felt the need of teaching-reteaching and testing in geometry because it was purely abstract. Mr.Manik Chak~~ravorty vociferously ad~~vocated to use the learning of mathematics. A good learner of mathematics will be calm and quiet,peaceful and disciplined.

Mr.Tapan Mohan Bhattarcharya pleaded for inculcation of proper attitude and habits in learning mathematics at the formative period of life. It would lead to make edifice of future learning strong. Such students can get mastery. Infact factors of mastery learning can be followed and achieved through remedial learning. He was of the view that while giving extra time for coaching the below average or even average children for teaching mathematics,adequate hometask should be given to engage them at home. The task need to be corrected with appropriate suggestions. Step by step teaching would be more benificial according to him.

Mr.Rathindra Deb felt to use problem solving method of teaching in the subject. The children need encouragement not the load of the books. Chinu Bhattarcharjee was of the opinion that wastage and stagnation needed to be checked by using resource materials such as mathematics kits, instrument box,charts,models and the photograph of mathematicians. The act makes teaching and learning attractive and joyful. The teacher should go slowly and parry some questions to maintain their attention and concentration. Drawing of Geometrical figures and measuring the sides and the angles with the help of geometrical instrument create extra interest of learning Chinu Bhattarcharjee expressed.

Mrs.Namita Ghosh advocated outrightly for strengthening classroom teaching by putting all resources at command. Constructing building,facilitating necessary teaching-learning materials, appointing qualified but motivated teachers and propagating the importance of mathematics learning increase classroom performances. Preparation of lesson plan, elaborating it within the time frame, revising the activities performed in the end and giving home assignment play vital role in regularising the students behaviour of learning. Mrs.Ghosh observed.Organising weekly - fortnightly unit test help the students to get ready for all eventuality. The teacher should adopt core skills of mathematics teaching in the classes. Illustrations and comprehensive activities bear the results.

Conclusion

However remedial teaching can not be a panacea to all prevailing ills of teaching-learning programme. In formal system classroom teaching acquires importance. All the students are expected to achieve learning outcomes with in the stipulated duration - session.

But unfortunately various disturbing elements have creeped into. Teachers do not discharge their duty sincerely and effectively. Their priorities are something else. Students even seem less sincere. Teaching is left on its own fate. Indifference from all sides plays negative role despite that the Governments are giving first priority to education sector and that is too to elementary education. Therefore it should be obligatory to all concerned to make formal education trust worthy and faithful.

The other course of action may arise only when some students find their problems unsolved. Remedial teaching can only be organised after or before the classes are held. But will the same teacher or new recruited teacher teach? Regular teachers may not agree to take up the job after spending whole day in regular classes. Fresh appointments put the Government in tight position. So if in between periods are alloted for remedial teaching that would be more poignant.

Some how if extra time is required, extra allowances may be paid to the regular teachers as incentive. In remedial teaching, private tution is practiced on large scale. Apart from State SCERTs/SIEs/Centre for Science and Mathematics Education, NEHU conducts courses in remedial teaching at different school levels.

Therefore it may be concluded that remedial courses in mathematics is highly essential for weak students to bring them to a particulars level. But it should not be organised in a haphazard manner. The problems of the students be diagnosed first and the course may be conducted accordingly.

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CHAPTER - IV

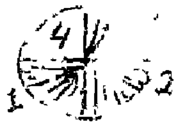
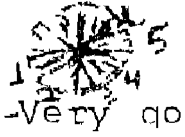
Lessons Prepared by the Participants

CHAPTER - IV

LESSON NO - I

TOPIC - FRACTION
CLASS - V.

Saibal Gupta
Tapan Mohan Bhattacharya

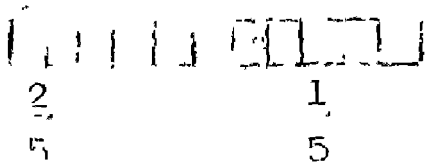
Difficulties faced by teachers	Difficulties faced by students	Probable Causes	Remedies suggested
Teacher finds difficult to explain numerator and denominator to the students. He does not find suitable aids to explain practically. He lacks ample techniques and communicative skills.	i) Forgetting the terms numerator and denominator and indentifying them $\frac{1}{3}, \frac{1}{4}$ ii) Mistakes in deriving equivalent fractions e.g. $\frac{3}{4} = \frac{6}{8}$ and vise versa.	Student fail to develop conception of fraction due to proper communication. Poor concept of fraction and less practices. Not getting proper guidance from home.	Practicing with a good number of sums and frequent checking improve the loss of memory. Practical examples Teacher Activities 1. Draw a circle, divide into 4 equal parts. Shade the equal 3 parts and keep one as blank. Student:- Drawn  (A) Teacher - Very good 2. Draw a circles, divide into 4 equal parts. Again divide each equal parts in to two shaded 6 equal parts. Keeping 7 and 8 blank. Student - Drawn  (B) Teacher-Very good Conclusion 1. The above diagram (A) and (B) represent equal fractions. First one may be written as $\frac{3}{4}$ and 2nd one as $\frac{6}{8}$. We may say in first case that 3 equal parts of

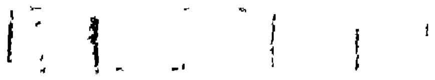
Difficulties faced by Teachers	Difficulties faced by Students	Probable Causes	Remedies suggested
			4 parts are shaded.3 is termed as numerator and 4 is denominator. 2.If we multiply both the numerator and the denominator of the fraction $\frac{3}{4}$ by 2, we get an equal fraction $\frac{3 \times 2}{4 \times 2} = \frac{6}{8}$ Therefore $\frac{3}{4} = \frac{6}{8}$ 3.Similarly,if we devide both numerator and the denominator of the fractions $\frac{6}{8}$ by 2, we get an equal fraction $\frac{6 \div 2}{8 \div 2} = \frac{3}{4}$ $\therefore \frac{6}{8} = \frac{3}{4}$

LESSON NO - 2

TOPIC - FRACTION ADDITION
CLASS-V

Swapan Barik
Sajal Chakravarty

Difficulties faced by Teachers	Difficulties faced by Students	Probable Causes	Remedies Suggested
	Errors as mentioned below are often observed to be committed by the students in solving problems on addition of vulgar fractions e.g. (i) $\frac{2}{5}+\frac{1}{5}$ $=\frac{2+1}{5+5}=\frac{3}{10}$ (ii) $\frac{3}{4}+\frac{3}{8}$ $=\frac{3+3}{8}=\frac{6}{8}$	Poor concept of the topic, lack of knowledge and of practice in addition of like fractions. Poor concept of transforming unlike fractions (These might have developed due to absence in the previous classes or lack of interest in those classes).	To remove such errors the idea of addition of like fractions may be discussed to them in the following manner by asking them. What is $\frac{2}{5}$? What is $\frac{1}{5}$? Expected replies would be 2 out of 5 equal parts of a whole and 1 out of 5 equal parts of a whole. Then they should be helped to draw figures as below:  i) The student are most likely to show the first two parts and the first part respectively. ii) Explain to them that they can be taken in any other order. Q. Now, if you add them how many parts will be there? Ans. 3 parts Q. But 3 parts out of how many parts? Ans. 5 parts or 10 parts. If the answer

Difficulties faced by Teachers	difficulties faced by Students	Probable Causes	Remedies suggested
			is 5 parts it is OK. But if otherwise the student will be misguided by the figure. Now, repeating the whole process by cutting a piece of bamboo or paper into 5 equal parts, it can be shown 3 out of 5 parts i.e., the sum is $\frac{3}{5}$ of the figure shown,  In the same process, explain to them that $\frac{5}{8}+\frac{2}{8}=\frac{5+2}{8}=\frac{7}{8}$ Now the following question may be asked for practice. $\frac{4}{10}+\frac{3}{10}$? $\frac{5}{12}+\frac{3}{12}$? and so on.

LESSON NO. 3

TOPIC : H.C.F.
CLASS : IV

Prantosh Datta

	Difficulties by Teachers	Difficulties by Students	Causes of weakness	Remedy	Remarks
H.C.F. and L.C.M. H.C.F. of $6x^3$, $9x^2y$.	For finding H.C.F. of $6x^3, 9x^2y$ the common difficulties the teacher will face is to add and substract the power.	The students may find the following diffuculties while calculating H.C.F. 1.How to reduce the powers. 2.How to understand which common factor is higher.	1.The students might have not understand H.C.F.teaching well in the class 2. They might have forgotten even. 3. They might have missed to remember the rules of addition and subtraction of powers.	1.At first the teacher have to give a brief idea of H.C.F. before calculation takes place. 2.That is which common things are in the eqn. $6x^3$, $9x^2y$ by which both will be divisible. They divide both the eqn. and underline as which will be H.C.F.	Quoting some example, he should calculate the H.C.F. such as $6x^3=2x3$ $2x3.x.x.x$ $x2$ $9x^2y=3.3.x.x.y$ So,H.C.F. of $6x^3.9x^2y=3.x.x$ $=3x^2$ Conclusion In both, the highest common factor is $3x^2$.

LESSON NO. 4

TOPIC : FRACTORISATION
CLASS : V

Mr. Rathudra Kr. De

Item	Difficulties faced by Teachers	Difficulties faced by Students	Causes of weakness	Remedy	Ramarks
1) Factorisation (Algebra).	No difficulties faced by the teacher.	Problem: $6x^3 + 8x^2y$. Done by the student as $6x^3+8x^2y$ $=2x(3x^2+4xy)$ which is incorrect.	Students may be unable to take the highest common factor due to lack of skills to do it. They may be memorising.	Frequent practice of doing sums of same type is essential (Drilling) Correct Answer: is as follows Factors of $6x^3$ are $2.3.x^2.x$ (i) and $8x^2y$ $=2.4.x^2.y$ (ii) $\therefore$ H.C.F. is $2x^2$ Now $6x^3+8x^2y$ may be written as $=2x^2.3x+2x^2.4y$ $=2x^2(3x+4y)$ Ans.	
2) Factorisation	No difficulties faced by the teacher.	Problem: $16m^2-36$. Done by the student $16m^2-36$ $=4(m^2-9)$ After this students fail to proceed.	Student does not know how to use the formula: a^2-b^2 $=(a+b)(a-b)$ or fail to apply.	Student should know the following formula which is very useful for factorisation; Through drilling students may be advised to remember them. i) a^2-b^2 $=(a+b)(a-b)$ ii) a^3+b^3 $=(a+b)(a^2-ab+b^2)$ iii) a^3-b^3 $=(a-b)(a^2+ab+b^2)$ Now, formula (i) may be applied in this case as $16m^2-36$ $=4(4m^2-9)$ (Taking Highest common factor) $=4\{(2m)^2-(3)^2\}$ $=4(2m+3)(2m-3)$	

Item	Difficulties faced by Teachers	Difficulties faced by Students	Causes of weakness	Remedy	Remarks
3) H.C.F.	No difficulties faced by the teacher.	Problem: to find H.C.F. of x^2-4, $8-x^3$, $6-x-x^2$ x^2-4 $=(x)^2-(2)^2$ $=(x+2)(x-2)$ ...(i) $8-x^3$ $=(2)^2-(x)^3$ $=(2-x)(2^2+2.x+x^2)$ $=(2-x)(4+2x+x^2)$ $=(2-x)(x^2+2x+4)$..(ii) $6-x-x^2$ $=6-3x+2x-x^2$ $=3(2-x)+x(2-x)$ $=(2-x)(3+x)$ ... (iii) ∴ H.C.F. = 1 But the process is not correct.	Students do not know how to change the sign (i.e. +, -) multiplying by -1. Students fail to factorise correctly.	Student will have to know changing the sign by multiplying -1. It should be done at home or in classroom. Correct Answer $x^2-4=x^2-2^2$ $=(x+2)(x-2)$ $=(x+2).-1(2-x)$ $=-1(x+2)(2-x)$ $=-1(x+2)(2-x)$ ...(i) $8-x^3$ $=(2)^3-(x)^3$ $=(2-x)(2^2+2x+x^2)$ $=(2-x)(4+2x+x^2)$ ....(ii) $=(2-x)(x^2+2x+4)$...(iii) $6-x-x^2$ $=6-3x+2x-x^2$ $=3(2-x)+x(2-x)$ $=(2-x)(3+x)$ .....(iv) ∴ H.C.F. $=(2-x)$	Drilling in factorisation for simple to harder cases

LESSON NO. 5

Name - Swapan Kr.Das Gupta

TOPIC - Number and Place Value
CLASS - III.

Item No	Difficulties faced by Teachers	Difficulties faced by Students	Caused	Remedy Suggested
1)Numbers a)Natural Number b)Prime Number c)Odd Number d)Even Number e)Compound Number	Teachers feel diffucult in communicating to the students properly as they have short memory.	Classifying different kinds of numbers.	Conception of different kinds of numbers is not clear to them.	Check and verify method. Can be adopted such as; (a)0,1,2,3,4,5,6,7,8,9,10. Find out the Prime numbers and natural numbers from 0 to 10.
2)Four fundamental operation regarding number	Teacher feel difficult to draw students mind for doing the sums in classroom situation due to their instable mind at the early stage.	Incase of addition and substraction 1)To place the number according to the place value say an example: a) 32 +9 122 24 x8 212 they place differently and thus get the results. 2)Defects of counting the carrying number. They put carrying number at a time.	i)They do not know how to write a number below the other number as per their place value. 2)If they forget the place value,and method of carrying, it will be difficult to solve the sum.	b)10,11,12, 13,14,15,16, 17,18,19,20. Find out the compound numbers among the numbers from 10-20. c)21,22,23, 24,25,26,27, 28,29,30. Find out the odd and even number from 20-30.The students may be required to practice class tasks. The teacher should do maximum blackboard work by making correct classification of numbers. He should check and veryfy the

Item No	Difficulties faced by the Teachers	Difficulties faced by the Students	Caused	Remedy Suggested
			3) In case of substraction the students feel difficulties from the following sums. it is obvious. a) 27 −9 22 b) 15 −6 55 i) To place the numeral as per its place value ii) Defects of carrying numbers i.e. they forget to reduce the number from the adjacent number which have been placed at ten hundred or thousands and or from the number of ten place.	writings of the students in their copies. Some numbers on the blackboard may be written and asked individually to justify their answers. For examples: 0,1,2,3,4,5 – Do you know 0,1 is what type of number? 6,8 are what type of numbers?

LESSON NO. 6

TOPIC : Four Fundamental Operations

Class - II.

Mr.Pradip Kr.Sahe

Item No	Difficulties faced by Teachers	Difficulties faced by Students	Causes	Remedies Suggested
Number:- Natural, Prime, Even, Odd and Compound.	1)The teacher faces the difficulties in communicating the students HCF/LCM due to poor understanding. Even they do not do 48=4x4x3 or =2x2x2x2x3.	1)The students are unable to distinguish between the numbers such as natural, even, odd, prime and compound. It leads to commiting a number of mistakes.	1)These difficulties arise due to maltreatment of students by teacher, lack of mental exercises and mechanical way of teaching which put the students mostly in confusion.	1)The teacher should ask the students in the class one by one to tick(✓) the number according to his asking and to mark as tabulated in the number from 1 to 100 such as 2 is Prime and even 3 is Odd 4 is even, 5 is Odd and etc The teacher should remind the students again and again in the class to do and remember.
2.Addition	2)It is often observed that the students commit mistakes in addition like 27 +5 25 +46 6(11) 57 +11 6(7)	These difficulties arise due to wrong placing of the number, carrying the member digit and wrong counting.	It occurs due to the students poor conception, want of concentration in the class want of interest in learning mathematics etc.	These difficulties may be removed by using counting sticks, marbles, symbolic marks etc. The teacher should ask questions to the students like, 2 and 1 how much? 3+1 how much?

Item No.	Difficulties faced by the Teachers	Causes	Remedy Suggested	Remarks
			What is the sum of 4 and 1 etc. The teacher should give the students easy problem in the classes to do such as 2 3 4 +1 +1 +1 Symbolic sums 12 + 3	
3) Subtraction	The teacher find difficult to make the students understand the sub-traction on carrying basis. Students commit such mistakes frequently 45 66 -37 -28 1(2) 38	It occurs due to misunderstanding in students about Maths. They fail to retain the knowledge explained by the teachers.	The teacher should give the students to work out easy substraction first as 2 3 4 -1 -1 -1 and thus simple to hard to more hard. The teachers should ask the question to the students in the class like you take away 2 from 4, what remains? When you take 3 from 5, what remains? He symbolic and tens and ones method addition and substraction should also be given for	In my five days training, I achieved some proper technique of teaching in Maths. This remedial teaching teaches how to make a slow learner to a fast. It teaches as how to make the students pioneer, how to make the understand easily and how a teacher can give the students concrete

Item No	Difficulties faced by the Teachers	Causes	Remedy Suggested	Remarks
			practice such as; 1. 24 -12 2tens + 4ones 1tens - 2ones 1tens + 2ones =12	Suggestions to study mathematics.
4)Multiplication.	The students often commit mistakes in placing the number digit and thus multiplication results are wrong (i) 213 x12 (ii) 213 x13 639 213	-	These common errors occur due to poor conception of the students in number, digit and their placement.	The teacher should clearly explain to the students the number, number digit and their placement and value calculation. First of all the teacher should ask questions from the students as; 1) 2x1 3x1 4x1 2) 2x2 2x3 2x4 Gradually simple to hard to more hard questions may be asked like: What makes 2 twos, 3 twos etc.
5)Division	It is often observed that the students commit common mistakes like 5 ÷ 5=0 0 ÷ 5=5 12 ÷ 3=9	-	Such mistakes are usually committed by a good percentage of students which leads to develop a wrong habits. This should be taken care of through remedial teaching.	The teacher should apply his skill to make the students clearly understood by explaining the following 2 ÷ 2= ? 3 ÷ 3= ? 4 ÷ 2= ?

APPENDICES

APPENDICES

TESTS TO KNOW WEAKNESSES AND THOROUGHNESS

Edited by Dr. M.M. Pandey

The teachers were given the task to construct some test items which could help in knowing their weaknesses or thoroughness. They were edited and presented as stated.

1. 2 of 4 ÷ 2 x 5 is
   (a) $\frac{4}{5}$
   (b) 10
   (c) 8
   (d) None of these Ans(a)

2. 8 ÷ 4 x 3 + 5 is
   (a) 6
   (b) 11
   (c) 2
   (d) None of these Ans(b)

3. Simplification of 25+30-7x(15÷3)+5 is
   (a) 15
   (b) 25
   (c) 30
   (d) 245 Ans(b)

4. Ramesh deposited Rs.10,000/- in his savings bank account Later he withdrew Rs.5,555/ from it. How much money was left in his account?
   (a) Rs.4445
   (b) Rs.15,555
   (c) Rs.5555
   (d) None of these Ans.(a)

5. A dealer purchased 100 colour television sets. If the cost of each set is Rs.8020/-, the cost of all the sets together is
   (a) Rs.8120
   (b) Rs.7920
   (c) Rs.80,2000
   (d) None of these Ans(c)

6. The cost price of 24 radio sets is Rs.18,720. Determine the price of one radio set
(a) Rs.18,744
(b) Rs.18,696
(c) Rs.18,720
(d) Rs.780 Ans(d)

Test the Statements

7. The H.C.F. of given number is not greater than any of the number (T/F)
Ans.(T)

8. The L.C.M. of given number is not less than any of the numbers.
Ans.(T)

9. H.C.F. of two Co Prime numbers is 1. Therefore to determine whether or not two numbers are coprime we see whether or not their H.C.F. is 1. (T/F).
Ans.(T)

10. The sum of –21, –3, 62, 20, –25 is
(a) 82
(b) 28
(c) –54
(d) None of these Ans.(b)

11. By adding the integers –245, 111 we find
(a) 356
(b) –356
(c) –134
(d) 134 Ans.(c)

12. The successor of 289 is
(a) 288
(b) 287
(c) 291
(d) 290 Ans.(d)

13. The predecessor of 275 is
(a) 273
(b) 277
(c) 274
(d) 276 Ans.(c)

14. The value of 24 + 15 ÷ 3 is
    (a) 42
    (b) 39
    (c) 29
    (d) 19 Ans.(c)

15. The base and exponent for 7 is
    (a) 5 x 7
    (b) 7 . 5
    (c) 5 . 7
    (d) None of these Ans.(c)

16. The vlue of 50^2 is
    (a) 50
    (b) 2500
    (c) 100
    (d) None of these Ans.(b)

17. The cube of 3, a natural, number is
    (a) 9
    (b) 6
    (c) 27
    (c) 3 Ans.(c)

18. 3 less than the quotient of a by b is
    (a) $\frac{b}{a} + 3$
    (b) $\frac{a}{b} - 3$
    (c) $\frac{b}{a} - 3$
    (d) $\frac{a}{b} \times 3$ Ans.(b)

19. The diameter of a circle is
    (a) Thrice its radius
    (b) Fourtime its radius
    (c) Twice of its radius
    (d) None of these Ans.(c)

20. The addition of $5x^3$, $-2x^3$, $3x^3$, $-5x^3$ is
    (a) x^3
    (b) $-7x^3$
    (c) $8x^3$
    (d) $15x^3$ Ans.(a)

21. By subtracting 5a - 3b from 2a+b-2 we get
(a) 3a-4b+2
(b) -3a+4b-2
(c) 3a+4b+2
(d) 3a-4b+2 Ans.(b)

22. Find the value of x in 5 (x+3) = 15
(a) 0
(b) 5
(c) 30
(d) 18 Ans.(a)

33. Shyam's father is three times as old as Shyam. If sum of their ages is 56 years, find their ages respectively.
(a) 42 years, 14 years
(b) 14 years, 56 years
(c) 14 years, 42 years
(d) None of these Ans.(c)

24. The relationship of speed with distance and time can be shown as
(a) Time = $\frac{\text{distance}}{\text{Speed}}$
(b) Distance = Speed x times
(c) Speed = $\frac{\text{Time}}{\text{Distance}}$
(d) Speed = $\frac{\text{Distance}}{\text{Time}}$ Ans.(d)

25. The weight of 60 books is 10Km, what is the weight of 72 such books?
(a) 18 Kg
(b) 12 Kg
(c) 60 Kg
(d) 72 Kg Ans.(b)

26. 20 Postcards cost Rs.3, how many postcard you can purchase in Rs.9?
(a) 60
(b) 27
(c) 180
(d) 6 Ans.(a)

27. 20% of Rs.150 is
    - (a) Rs.20
    - (b) Rs.30
    - (c) Rs.170
    - (d) Rs.130 Ans.(b)

28. The relationship of profit with selling price and cost price is (when S.P. > C.P.)
    - (a) Profit + Cost Price = Selling Price
    - (b) Cost Price = Selling Price - Profit
    - (c) Cost Price = Selling Price - Cost Price
    - (d) None of these Ans.(c)

29. A sum of Rs.400 is lent for 3 years at the rate of 6% per annum. The interest is
    - (a) Rs.36
    - (b) Rs.72
    - (c) Rs.18
    - (d) None of these Ans.(a)

Test the following Statement.

30. Three or more lines are concurrent if all of them pass through the same point which is called their points of reference. (T/F.)

Ans.(T)

31. Point occupies a position and its location can be ascertained. (T/F)

Ans.(T)

32. Plane is a flat surface which extends indefinitely in all direction (T/F).

Ans.(T)

33. A line segment is not a portion of line (T/F).

Ans.(F)

34. The distance between two points is the same as the length of the line segment joining these points (F/T).

Ans.(T)

35. If two parallel lines are intersected by a transversal, then test the following statements.
    - (a) all pairs of corresponding angles are equal (T/F) Ans(T)

(b) all pairs of alternate angles are unequal (T/F)
Ans.(F)

(c) interior angles (or exterior angles) on the same side of the transversal are supplementary (T/F)
Ans.(T)

36. Lines perpendicular to the same line are not parallel to each other (T/F)
Ans.(F)

37. Lines parallel to the same line are parallel to each other (T/F)
Ans.(T.)

38. Pictorial representation of the numerical data using picture symbol is called the pictograph of the data (T/F)
Ans.(T)

39. A sum of Rs.200 is lent for 1 year at the rate of 10% per annum. The interest is
(a) Rs.10
(b) Rs.15
(c) Rs.20
(d) Rs.30 Ans.(c)

40. 50% of the population of a town are women. If the total population of the town is 10,000 the population of the gents is
(a) 10,050
(b) 5000
(c) 9950
(d) None of these Ans.(b)

41. If 16a = 256, the value of a is
(a) 16
(b) 8
(c) 32
(d) 64 Ans.(a)

42. $\frac{1}{5}$ $\frac{3}{10}$ $\frac{7}{5}$ is
(a) $\frac{9}{10}$ (c) $\frac{5}{10}$
(b) $\frac{14}{10}$ (d) $\frac{-9}{10}$ Ans.(d)

43. .05 x .05 is
   (a) .025
   (b) .2
   (c) .002
   (d) 25   Ans.(c)

44. The difference between 108.050 & 96.20 is
   (a) 12.030
   (b) 11.850
   (c) 118.50
   (d) 120.30   Ans.(b)

45. $\frac{3}{5} + \frac{4}{5}$ is equal to
   (a) $\frac{3}{4}$
   (b) $\frac{4}{3}$
   (c) $\frac{12}{25}$
   (d) $\frac{25}{12}$ Ans.(a)

46. 83465-163+25 is
   (a) 83981
   (b) 83619
   (c) 362
   (d) 83327   Ans.(d)

47. A cow is purchased for Rs.585 and sold at Rs.650, the profit is
   (a) Rs.235
   (b) Rs.50
   (c) Rs.65
   (d) 65   Ans.(d)

48. 7x+3x-2x+x =27; x = ?
   (a) $\frac{27}{10}$
   (b) 8
   (c) $\frac{27}{13}$
   (d) 3   Ans.(d)

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THINGS TO BE.REMEMBERED

Compiled -Dr.M.M.Pandey

During the Workshop, the participants were asked to write the symbols, formula, main points and the zeast to be remembered to make mathematics learning easy. They wrote what ever they could feel useful and helpful in solving the mathematical sums of its different branches. Later on those were scrutinised, compiled and presented in the following forms.

1. Operational symbols are; plus(+), minus(-),multiplication(x) and division (÷).
2. Four fundamental aspects of mathematics are addition, subtraction,multiplication and division.
3. L.C.M. means lowest common multiple and H.C.F. means Highest Common Factor.
4. Face value of a number (digit) increases or decreases as per its placement.
5. The symbol of decimal is '.'
6. While multiplying the operational symbols,we get +x-= -; +x+=+. symbols are denoted as 'sign' also.
7. The smallest natural number is 1 and the smallest whole number is 0 (Zero).
8. The successor of a whole number is 1 which is more than the whole number and the predecessor of a whole number is 1 which is less than the whole number.There is no predecessor of Zero in whole numbers.
9. The largest natural number and largest whole number do not exist.
10. Our numeration system is known as Hindu-Arabic having base 10 or the decimal system. It uses only ten symbols such as 0,1,2,3,4,5,6,6,8 and 9 which are called digits. Every whole number can be written with the help of only these symbols.
11. If x,y,z etc. are whole numbers,then
    (a) (x+y) is a whole number
    (b) (x x y)
    (c) x ÷ y
    (d) (x-y) may or may not be a whole number

(e) $x+y = y + x$

(f) $x \times y = y \times x$

(g) $x - y \neq y - x$ $(x \neq y)$ ($\neq$ stands for 'is not equal to')

(h) $x \div y = y \div x (x = y) (x \neq 0, y \neq 0)$

(i) In general, $x \div y \neq y \div x$

(j) $x + (y+z) = (x+y) \times z = (x+z)+y$

(k) $x \times (y \times z) = (x+y) \times z = (x \times z) \times y$

(l) Generally $x - (y - z) \neq (x - y) - z$
and $x \div (y \div z) \neq (x \div y) \div z$

(m) $x+0 = 0+x = x-0 = x$
and $x \times 0 = 0 \times x = 0$ and $0 \div x = 0 (x \neq 0)$

(n) $x \times 1 = 1 \times x = x \div 1 = x$

(o) $x \times (y+z) = x \times y + x \times z$ for $y > z$

(p) If x is divident, $y (y \neq 0)$ divisor q quotient and r remainder then we may write $x = yq+r$.

12. The letters used to represent numbers are called literal numbers or literals.

13. The literal numbers and their combination numbers obey all the rules alongwith signs of addition, substraction, multiplication and division as well as the properties of operations.

14. A quantity having fixed numerical value is called as a constant.

15. A quantity taking various numerical value is called a variable.

16. In an expression like y^3, x^4, p^5, q^6, z^7 etc. 3, 4, 5, 6, 7 are called indices or exponent.

17. A number or combination of numbers (including literal number) using the signs of fundamental operations, is called an algebraic expression).

18. If an expression contains one term is called a monomial, two terms is called a binomial and if three terms, is called trimonial.

19. The signs ('+' or '-') separate an expression into many. Each part along with its sign is called a term of the expression.

20. The sum or difference of many like terms is another like terms whose co-efficient is the sum (or diffe-

rence) of those like terms.

21. A statement of equality involving one or more literal number is called an equation.

22. An equation involving only one literal number with the highest power is called a linear equation in one variable.

23. While solving equation, we are adding, sub-tracting, multiplying and dividing (non-zero) the same number from both sides of the equation.

24. The ratio of a number x to the another number y ($y \neq 0$) is the quotient $x \div y$ and is written as $x : y$ where x and y are called its terms.

25. Equality of two ratios is called a proportion. The numbers a, b, c, d can be expressed in proportion if the ratio of first two is equal to the ratios of last two.

26. The first and fourth terms of a proportion are called the extreme terms but the second and third terms are called the means or middle terms.

27. Four numbers are in proportion if the product of extreme terms is equal to the product of middle terms.

28. If $a : b = b : c$, a, b, c, d, are said to be in proportion

29. If the middle term is repeated, each of the middle term is called the mean proportional.

30. "The method of finding first the value of one (Unity) quantity from the values of the given quantities and then the value of the required quantities is called the Unitary Method".

31. A fraction having its denominator 100 is known a percent. Even a ratio having its second term 100 is also called a percent.

32. For converting a ratio into a percent, it is written as a fraction and then multiplied by 100.

33. For converting a decimal into a percent, decimal point is shifted to two places to its right.

34. When a percent is converted into a fraction, the percent sign (%) is droped and the remaining number is multiplied by 100.

35. While converting a percent into a ratio, percent sign (%) is droped and a ratio with the remaining number as the first term and 100 as the second term is formed.

36. When a percent is converted into a decimal percent sign (%) is droped and the decimal point is shifted to two places to the left.

37. When S.P. $>$ C.P.
the profit = S.P. − C.P.
If S.P. $<$ C.P., then
Loss = C.P. − S.P.

38. $$\text{Profit } \% = \frac{\text{Profit}}{\text{C.P.}} \times 100$$

$$\text{Loss } \% = \frac{\text{Loss}}{\text{C.P.}} \times 100$$

39. The money borrowed from a lender is called Principal The additional money paid back after a fixed period alongwith the Principal is called Interest.

40. The total money paid at the end of fixed time is called amount. Thus, amount = Principal + Interest.

41. Interest of a given sum may be calculated by applying idea of percent and unitary method.

42. Interest is called simple if its calculation is made on the original principal throughout the plan period.

43. Point occupies a place which can be ascertained. Unlimited number of lines can be drawn through a given point.

44. Line is straight which can be extended in both the directions.

45. Likewise plane is a flat surface which can be extended in all the directions.

46. Only one line passes through two points in a plane. It wholly lies in that plane.

47. A line can be denoted by a simple small letter of English alphabet (l,m,n, etc) or by $\overrightarrow{AB}$ by using any two points A and B on it.

48. Two lines in a plane either interect at exactly one point or are parallel.

49. Three or more points are collinear if all of them lie on the same line.

50. Three or more points are concurrent if all of them pass through the same point that is called their point of concurrence.

51. Two planes either intersect or are parallel, and if they intersect, they are intersected in a line.

52. A line segment is a portion of a line which has two end points and a line has none.

53. There is a unique line segment joining two given points A and B which is denoted as $\overline{AB}$. The length of line segment AB is denoted by AB.

54. Two or more than two line segments having the same length are said to be equal.

55. 1m = 10cm - 1000mm, 1cm = 10mm
1km = 1000m, 1yd = 3 ft = 36 inch,1ft = 12 inch
1 mile =1760yd.

56. A Ray AB has one initial point (or end-point) A and extends indefinitely in one direction. Ray AB and BA are two different Rays.

57. Two rays having same initial point but directed in the other directions of the same line are termed as opposite rays.

58. An angle is formed by two rays with the same initial point. Initial point is called as vertex and two rays as the arm of the angle.

59. 1 complete angle = 4 right angles = 360°
1 straight angle = 2 right angles = 180°
1 right angle =90, Zero angle = 0°
$0^\circ \angle$ acute angle $\angle 90^\circ$, $90^\circ \angle$ obtuse angle $\angle 180^\circ$
$1^\circ = 60'$, $1' = 60$

60. Two angles with a common vertex, a common arm and other arm lying on the opposite sides of the common arm form a pair of adjacent angles.

61. Two angles having their sum 90° are called complementary angles and having their sum 180° is called supplementary angle.

62. Lines intersecting at right angles are said to be perpendicular to each other.

63. Rays and segments are said to be perpendicular if the corresponding lines determined by them are perpendicular.

64. Only one line can be drawn perpendicular to a given line which passes through a given point not lying on it.

65. If two lines intersect, then vertically opposite angles are equal.

66. Two angles if form a linear pair are adjacent and supplementary.

67. Two supplementary angles may not form a linear pair.

68. Two parallel lines have equal distance everywhere.

69. Lines which do not intersect in a plane are termed as parallel lines.

70. A line intersecting two or more given lines at different points is called a transversal to the given lines.

71. If two parallel lines are intersected by a transversal, then
    (i) all pairs of corresponding angles are equal
    (ii) all pairs of alternate angles are equal

72. If two lines are intersected by a transversal and if any one of the following is true
    (i) One pair of corresponding are equal
    (ii) One pair of alternate angles are equal
    (iii) A pair of interior angles (or exterior angles) on one side of the transversal are supplementary then the two lines are parallel.

73. Lines perpendicular to the same line are parallel to each other.

74. Lines parallel to the same line are parallel to each other.

75. Pictorial representation of the numerical data using picture symbols is called the pictograph

of the data.

76. Easy comprehension of the given data can be made from bargraph.

77. 1 is a factor of every number. It is the only number which is neither Prime nor Composite.

78. 2 is the only even prime number

79. Prime number has only two factors but composite number have more than two.

80. Coprime number have 1 as their only common factor. Therefore the H.C.F. of any prime number is equal to 1.

81. Every number is a factor as well as a multiple of itself.

82. Primes occuring in pairs with a difference of two are called twin primes.

83. A factor of a number divides the number exactly.

84. Throughout the country the numerals formed by 0,1, 2,3,4,5,6,7,8 and 9, the ten digit are used. Some states use the numerals formed by ten other digits such as 0,१,२,३, ४ ५, ६, ७, ८ ९

The numerals formed by the digit in first case are called Indo Arabic numerals or international numerals. Other than this are known as regional numerals.

85. Roman numerals are also commonly used. The pages of the books, hours minutes and seconds in the watches etc. are marked by Roman numerals. The files volumes of the books classrooms, parts of the question, sub-articles etc are all denoted by such numerals.

86. Unlike other numerals, Roman, numerals are formed by only 7 symbols -I,V,X,L,C,D and M. The value is given in the table.

Roman Symbol	I	V	X	L	C	D	M
Value of Symbol	1	5	10	50	100	500	1000

87. The fraction is written with two numerals arranged one over the other being separated by a line ' The numeral above the line is called numerator and the numeral below the line is called the denominator of the fraction.

88. The sum of two or more fractions having the same denominator is

$= \frac{\text{sum of the numerators}}{\text{denominator}}$

89. The difference between two fractions having the same denominator is

$= \frac{\text{difference between the numerators}}{\text{denominator}}$

90. A match box may be cuboidal; bamboo and a pipe are cylindrical; a sharpened pencil is conical and a ball may be termed as spherical in shape.

91. Square has four equal sides and four corners (vertex) of 90°.

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